ELECTRICAL REVIEW

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 3, No. 11. WEEKLY. | NEW YORK, THURSDAY, NOVEMBER 15, 1883. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1883, by DELANO & COMPANY, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

Applications of Electricity on Railroads.

The Munich Exhibition of Electricity, which at first was only intended to provide for means of making electro-technical experiments on light machines, electric lamps, telephones, conductors, &c., contained, nevertheless, some other interesting applications, and among others electric signals on railroads. Three companies only represented that class at the Exhibition:

1. The General Direction of Railways in the Kingdom of Bavaria.
2. The Royal-Imperial Private Society of the Austro-Hungarian; and,
3. The Company of the French Northern Railway.

Each one of those companies had exposed the principal electric apparatuses in use to attain the safe working of their respective lines. Those apparatuses are generally known, and the most of them have been described in this REVIEW; therefore we will only give here a summary description of the main ones, indicating their purposes and workings.

The General Direction of the Bavarian Railroads had exhibited three station posts, two of which were terminus posts, and the other was an intermediary post; Siemens' bells with optic signals; one semaphore with manœuvre control; one Bell, also Siemens' system, used to send, from some point between two neighboring stations, dispatches in Morse's characters, or relief calls.

The Royal-Imperial Private Society of the Austro-Hungarian Railways, with a very few unimportant exceptions, had also exposed the same apparatuses exhibited at the Paris International Exhibition of 1881, which likewise were described in this paper.

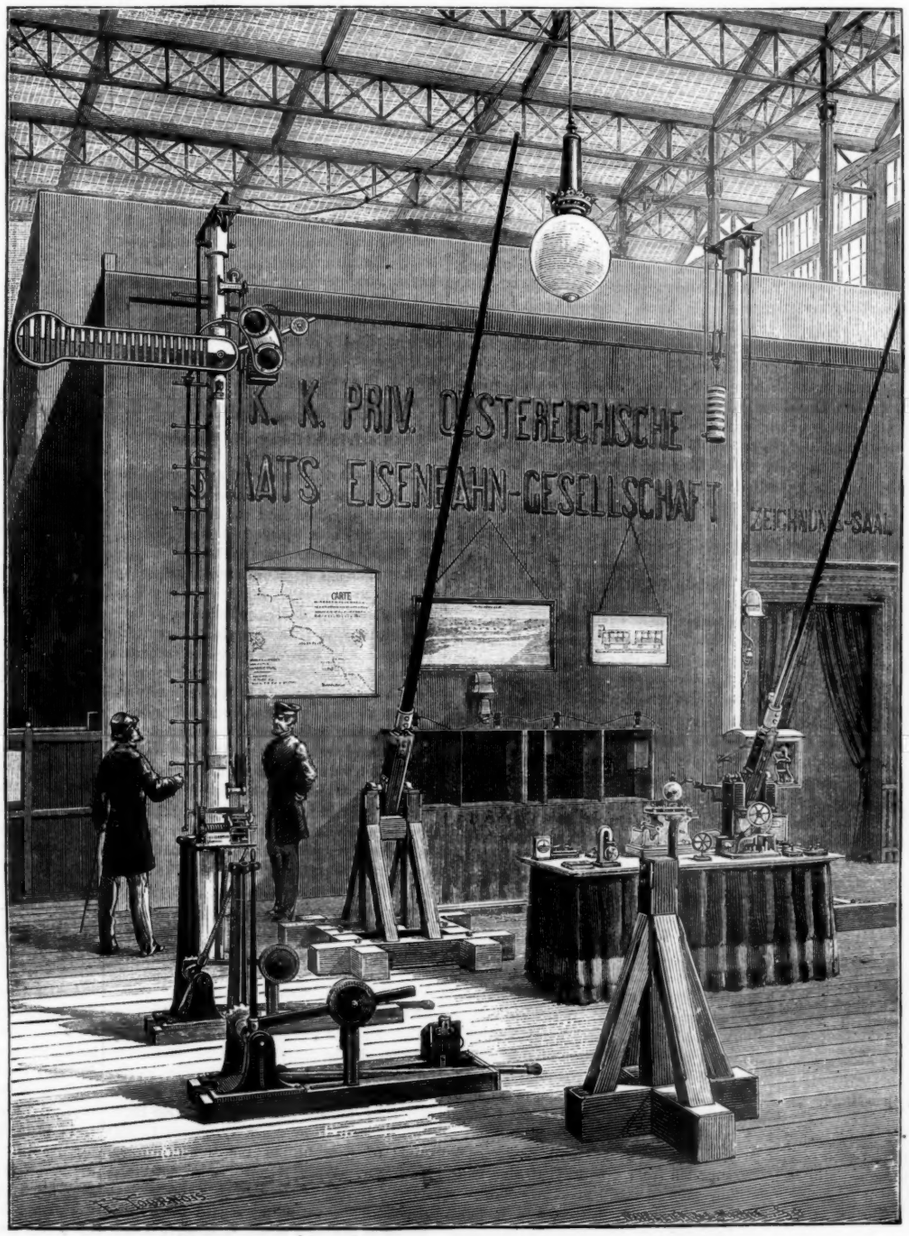


FIG. 149.—ELECTRICAL APPLIANCES FOR RAILWAYS, EXHIBITED AT MUNICH.

They consisted of—see Figure 149, which represents a general view of the articles exhibited by this society—an electric gate for level crossings, acting by the means of a clock-work moved by a counterweight. The source of electricity was in a magnetic inductor provided with a commutator which allowed, first, to act upon the alarm clock-work, which warned the passengers when the gate was about being closed, and then the gate itself; a controlling alarm was ringing during the whole time the gate was shut. Finally, that system of gates was articulated at one of its extremities, so as to allow, in case of neglect or imperfect working of the machinery, the crossing of carriages or foot-goers; it would close by its own weight as soon as it was no longer sustained by the one which passed through the level crossing.

That society further exhibited a semaphore, which was, I believe, yet in a state of experiment. It was set into motion by machinery similar to the one of the electric gates, and the position for open way or closed way answered to the position of the needle which commanded the entrance of the main tracks. To that purpose a commutator, which acted on the semaphore only in a determined position of the needle, had been disposed upon the course of the rod, which commands the needle. Finally the counter-weight which set the semaphore into motion was provided with a controller (or counter register) indicating the moment when it needed winding up.

The signals which are transmitted by the bells of Leopolder's system, used by the Society, are registered very automatically by an apparatus placed in the general circuit. Each signal is rendered by a stroke of the bell, and a hole punched in a paper band which unrolls at each disengaging stroke of the mechanism.

That Society likewise exhibited the inter-communication system used on their passenger trains, which was merely the Prudhomme's system slightly modified. In the first-class cars, single pressure knobs, protected with a leaf of paper, were fitted up. By a pressure on one of such knobs, a small disc would protrude outside of the carriage, and cause the ringing of the alarm-work so long as the disk had not been pushed back by hand.

Finally, in certain passenger cars, indicators of the main stations, through which the train was to pass, were installed; they were acted upon by the conductor of the train by the means of a special commutator connected with the inter-communication wires.

The Company of the French Northern Railway nearly entirely reproduced at Munich their interesting exhibition of 1881. The presence of their diminutive train attracted, as in Paris, a great many visitors. I will summarily indicate the apparatuses exposed, which have also been described in this paper.

At the first rank figured the manœuvre apparatuses for the electro-semaphores of Tesse and Lartigue's system, used in France on the Northern, Eastern and Orleans Railways.

I am going to recall in a few words what were the principles of those apparatuses and their characteristic qualities.

The way of management, generally known as the Block System, consists in the substitution of the interval of the distance run over by the trains, to the interval of time elapsed between successive departures in

order to insure a regular space between them.

The principle of the Block System applied on the Northern Railway, is the absolute Block System. It consists in dividing the road into sections, and not allowing a train to enter one section before the preceding train has left the same section. No exception to that rule is permitted, but after a certain time has elapsed since the passage of the last train, and after the performance of the proper formalities and by taking such precautions which assimilate the train that enters a blocked section to a train which would run to the help of another train stopped in distress.

The semaphores of Tesse and Lartigue nearly completely realize the programme of the Block System. In a short time those apparatuses will be still perfected by the addition of an engagement connecting the long arm with the short arm and the disk signal distance.

Alongside of the apparatuses of the Block System, figured the repeaters of the electro-semaphores for the depots and the level crossings. The first consists in a sign hanging on a soft iron rod which oscillates like a pendulum between the two poles of the large magnets; the second is composed of a cast-iron box containing two Hughes' electro-magnets, each of which is bearing a small pinion slightly inclined toward the fall.

On the diminutive train, composed of a locomotive, two freight cars, and a first-class passenger car, built one-eighth of the working size, we find the electric intercommunication of the Prudhomme's system, which allows the passengers to call the agents of the train, and indicates a breaking of the draw-gear; the electro-automatical disengagement of the continuous vacuum brake (or air-brake), which can be worked upon from the freight cars, or by the passage of the locomotive over a fixed contact placed on the track and connected with a disk sign at a distance giving the stopping signal.

The company also exhibited their system of inductors with two kinds of commutators to work the large series of alarm bells on the single track.

This apparatus, installed at any point on the road, can be used to transmit by the means of the alarm bells, the signals of usual relief.

We observed further, in the exhibition of this company, the indicators of the level crossings, with bellows pedal, mercury pedal, special quivering alarm; an apparatus for electro-automatical protection, which signalled to the stations and switchings the passage of a train before a disk sign at distance, and indicated to the following train that it is preceded by a train at short distance; diverse electric apparatuses controlling the switches for change of tracks; disk signs at distance; stopping disk signs; disengaging gears for connecting stations; apparatuses for wicket and dial correspondence between the switchmen and brakemen; a system of relief appparatus installed in the guard-houses in open road; sundry apparatuses composing the telegraph offices at the depots, and electric controllers of the water level in the station water tanks.

La Lumiere Electrique.

Safety Gates at Road Crossings.

The Owasco River Railroad, running into Auburn, N. Y., is to be equipped with electric gates for crossings. The gates will be set over the tracks so that their tendency, through the influence of a spring at the hinged side, will be to fly open, but they will be held shut by electrical catches. As a train approaches the gateway from either direction, the first set of wheels coming in contact with a spring set by the rail at some distance from the gate closes a circuit and releases the gate so that it flies open. Then the pressure of the wheels upon a double lever arrangement by the side of the track keeps the levers down until the last truck has passed through the gateway, when the lever will rise again and the gate is automatically closed behind the train. In addition to opening the gates at each crossing, as the train approaches the apparatus it causes gongs to sound continuously until the gates are closed again, and also swings out two danger signals—one for the street and one over the sidewalk.—*Railroad Gazette.*

Electric Railroad on Mt. Desert.

A company of Bangor gentlemen propose to build a narrow-gauge railway from Bar Harbor to Eagle Lake, Mt Desert, a distance of three miles. The road will connect with the steamer which runs across the lake to the terminus of the Green Mountain Railway. This subject was agitated last summer, as the road from Bar Harbor to the lake is very dusty, and therefore uncomfortable to ride over in the barges. The corporation is to be known as the Mt. Desert Railway. Those interested in Bangor are Messrs. W. B. Hayford, C. V. Lord, T. N. Egery, F. W. Cram, F. M. Laughton, F. H. Clergue, C. F. Bragg, Sumner Laughton, and F. W. Goodwin. There are also interested in the enterprise Messrs. Payson Tucker and Wm. A. Allen, of the Maine Central Railroad. An engineering party, under the charge of Chief Engineer Allen, of the Maine Central Railroad, will at once commence the survey. The promoters are now investigating a new method for running railway trains by electric power, and it is probable this will be adopted on the Mt. Desert Railway.

The Railway Cab Electric Signal Company, New York, have got their signaling apparatus in operation on some parts of the elevated railroad. It is an electric block system. An electrical apparatus, operated by a small dynamo on each locomotive, closes the block till the train has passed out. The signaling is done by bells or whistles, these being automatically sounded should an engine enter a block before the preceding train has left it. By means of boxes along the line a block can be closed, if it becomes necessary to stop a train for any purpose. The means of electric transmission used is wires passing alongside the track, and connected to insulated rails at the signaling points.

Electric Lighting of Railways.

It is dangerous in science to say what can not be done. Down to a very recent date the production of an electric light from a galvanic battery at a cost low enough for every day use, was deemed by professional electricians as impracticable. All possible combinations of chemical elements that could be a source of energy were supposed to be so well known that an electric engineer would almost as soon spend his time in attempting to realize perpetual motion as in the quest of a primary battery to produce efficient economical electrical illumination. Nevertheless, the problem is soluble. The "Cheeswright Railway Electric Light" is actually in partial operation on the Great Northern Railway, and carriages are being fitted for it on the Southwestern and Great Eastern, and some other lines. It dispenses wholly with steam engine and dynamo for its supply, and depends solely on the old voltaic battery with certain novel combinations of the elements. An exhibition of this system took place yesterday at 31 Nicholas Lane, the offices of Mr. William Gammon, manager of the South Wales department of the London and Southwestern Railway. Six incandescent lamps, of about six candle power each, were supplied from a battery of nine cells, and they gave an excellent steady light. A number of gentlemen interested in the lighting of railway carriages, which is the leading object of the patentees, were present, and expressed decided satisfaction with the steadiness and brightness of the light and the extreme simplicity of the apparatus. It was stated that eighteen of these lamps, equal to 100 candle-power, suffice for a Pullman car, that the whole weight of the battery would not exceed three and one-half hundred weight, easily carried beneath the vehicle, and that a single charge would last from twenty to twenty-five hours. The current can be switched on or off with ease, so as to light or extinguish all the lamps of a carriage, or, if connected, of a whole train instantaneously. A single installation for a railway carriage would cost from £10 to £12, which is said to be not more than of the first cost of gas. It is claimed further by Mr. Zohrab, the engineer in charge of the apparatus, that the elements employed can be sold after they have done duty in the battery as chemical compounds for as much value as they cost in the first instance, and that the price of working would be not more than that of gas and for a superior light. These are points on which we offer no opinion; they can be determined only by actual trial, and this is now being made. The traveling public are interested in the efficient lighting not only of railway carriages but also of street conveyances. It is probable that some of the metropolitan tram-cars will soon test the applicability of this system to their wants, and there seems no reason why it should not be adopted in omnibuses. The dead weight need not exceed half a hundred weight for an omnibus, which would then be well and pleasantly lighted. As matters now stand, anything more cheerless than some of our street conveyances on a dark, wet, misty night can hardly be pictured. Nothing can be more wretched—not to say dangerous—than the dark, cavern-like interiors into which passengers have to find their way. Any inventor would be a public benefactor who would enable omnibus proprietors at a most moderate cost to provide us with such brilliantly lighted carriages. Granting always that the cost of charging the batteries is no greater than is affirmed—which experience only will prove—a decided step appears to have been taken in the employment of electric light under the difficult conditions inevitable to a running vehicle.—*London Telegraph.*

Electric Railways in Vienna.

The project of a high-level railway for the City of Vienna has failed, because the capital could not be raised, and the Austrian Government has now granted Messrs. Siemens and Halske a concession for the preparatory works for a net of electric railway lines by which communication in the city would be greatly facilitated. The contractors will have three distinct periods wherein to build the railways. The first will comprise the completion of a line from the central town to the Danube Canal and several suburbs through which no tramways go at present. The same firm, some time ago, opened a small line of electric railway to the Electric Exhibition, which was so great a success as to induce two syndicates of banks—the one represented by the Lander Bank, the other by the Vienna Banking Union—to offer to find the necessary capital for the new undertaking, namely, 40,0000,000 to 50,000,000 florins.

The Electric Railway.

PREPARING TO TEST ITS POWER ON THE ASCENT TO MT. MCGREGOR.

The Saratoga *Journal* has the following: "One mile and an eighth of rail has recently been laid in the center of the Mt. McGregor railway track, from the engine house northward, for the purpose of testing the electric motor by means of which Mr. Leo Daft, electrician, of New York, proposes to pull trains of cars up to the summit of Mt. McGregor. Were it not for recently developed wonders connected with applications of electricity, we might regard the experimenter as having a highly suggestive name, and being a very visionary man to expect to overcome such a grade as the mountain road has, with a simple machine which will be placed on a platform car for the purpose named; but Mr. Daft is sanguine of success, as is also Mr. M. B. Emory, of New York, under whose supervision the work has thus far been done. The latter has a force of men at work spiking down and adjusting the rails, and says that it will be ready for tiial on Saturday of this week, but the experimental trip will probably not take place until the 10th of November as already stated in the *Journal*. The center rail is of the same pattern as those originally laid, and differs from them only in being laid half an inch higher. The theory is to transmit a continuous current of electricity through these rails to the machine in the advance of the train, which will do the work required. The current will be generated by the stationary engine at the Gossamer Rubber Works.

Electric Cars in Paris.

SUCCESS OF THE NEW MOTIVE CARS IN THE FRENCH CAPITAL.

An electric tramcar trial was successfully accomplished recently in Paris by the French Electrical Power Storage Company. At three o'clock the vehicle, an ordinary three horse tramcar, left the Place de la Nation, in the far east, and after traversing the capital through important thoroughfares reached the starting point soon after six o'clock. A distance of thirty English miles was thus made in about three hours. The mute wonderment with which the soundless progress of the apparently animated car through the crowded streets was witnessed by the public may be imagined. There was not the slightest accident. Not a single horse shied throughout the entire route. Whenever there was an impediment, the driver, directed by M. Philippart, the manager of the company, who was ever on the alert, had no difficulty in bringing the vehicle to a standstill at a second's notice. The ease with which the car was turned off one set of tram lines and got on to another across several yards of unmetalled ground was likewise admirable.

THE MECHANISM.

The locomotion is effected by means of Faure accumulators, weighing some fifty hundredweight, which are fixed under the tramway seats and connected with a Siemens' machine placed under the floor. The machine, which makes 1,200 revolutions a minute, sets in movement, by means of a pulley, an axle, to which are connected the chains which give impulse to the wheels. These wheels revolve sixty times to twelve thousand revolutions of the machine. The speed of the electric tramcar is nine and a third miles an hour on level ground, and five and a half miles on an ascent. The present tram lines are not well adapted for the new locomotion. On the newer lines the movement was sufficiently smooth, but on those that have been laid for some time there was a marked difference, and the actual working force was considerably lower than the indicated horse power. The experiment, however, says the correspondent of the London *Standard*—the first ever made over a long distance—fully proves the practicability of electric tramcars, and it may safely be predicted that before long they will take possession of the tram routes of the French capital. The estimated cost is one-half that of horse cars.

Electric Launches.

At the recent meeting of the British Association, Mr. A. Reckenzaun read a paper "On Electric Launches." He described the boat *Electricity*. It has one Siemens D_2 dynamo connected directly to the screw shaft, upon which is a propeller with two blades; diameter 17⅜ inches, pitch 11½ inches, and area of blade surface 66 square inches. Yarrow and Company, in conjunction with the Electrical Power Storage Company, have fitted up a launch, which has been sent to the Vienna Exhibition. This is 40 feet long by 6 feet beam, and can carry forty passengers. The motor is a Siemens D_2 machine, which develops 7 horse power with 80 cells, and a current of 40 amperes. The screw is two-bladed of thin forged steel, with a diameter of 19 inches, and a pitch of 13 inches. The weight of the motor and batteries combined is 2¼ tons. During the trial the speed of the boat was over eight miles an hour, the current used at the time being 41.22 amperes, and the counter electromotive force 112.5 volts, with 60 cells in circuit.

Mr. J. Clark, of Glasgow, described a wooden boat, clinker built, 21 feet long over

all by 4 feet 4 inches beam, and drawing 12 inches of water with three or four persons on board. She is fitted with an electric motor coupled direct to the propeller shaft, and her power is derived from two battery boxes 3 feet long by 8 inches wide, and 12 inches high, which can be utilized as seats. The batteries require recharging with chemicals about every four hours of continuous use, one battery driving the boat at three quarters speed, while the other is being recharged. During several trials at Kilcreggan-on-Clyde, a speed of a little over five miles an hour was obtained, the motor running at 600 revolutions per minute. The weight of the boat complete, with batteries charged, is 4 cwt. Clark's electric launches are now being built by Messrs. Gilbert Bogle & Co., of Glasgow, of varying sizes, from 15 feet long and four miles per hour speed to 30 feet long and seven miles per hour speed. The author gave no clew as to the nature of his batteries or to the cost of working them.

Sir William Siemens said that there were many applications in which the secondary battery would be most useful, but it was a mistake to suppose it could be employed for every purpose. For instance, it was foolish to endeavor to adopt them for driving tricycles; but in launches, where the machinery was perforce very cramped, they promised excellent results. The great question was whether the secondary battery would last or whether it would perish. In order to test this point quietly he had put down batteries in his own house last autumn, and he had found them satisfactory so far. He charged them all day, and at night he used both them and a small dynamo to feed his lamps. In the case of a launch the machine could not be taken with the boat, and consequently the navigation would be confined to short stages.

Sir James Douglass pointed out that an electric launch was much more easily swung from the davits of a ship than a steam launch, and that it offered greater security at sea. There was no fire to be put out if two or three waves were shipped, and the machinery would work under water. There was also a saving in the number of attendants, one man only being required.

In Re the Electric Light.

And now, says the Boston *Sunday Globe*, comes the Merchants' Electric Light and Power Company, whose beautiful white lights shine in this city to the number of 550, and deposes and says that its new lighting station on Congress Street is to be the largest and best equipped in the world, that such is the economy of its system that it defies competition, that it is about to increase its capacity to 1,000 lights, and that it is earning 10 per cent. on its capital, and can earn twice as much when its new station is complete and running.

Electrical Storage Batteries.

At the recent meeting of the British Association, in the Mechanical Science Section, Mr. A. Reckenbaum read a paper on "Electric Launches," in which he gave a description of the launch *Electricity*, which made her first trip in September, 1882. She is 25 feet long, with 5 feet beam, and draws 21 inches forward and 30 inches aft. Her speed is 8.3 miles per hour with ten passengers on board. Forty-five Sellon-Volckmann accumulators supplied the current to two Siemens dynamos. A Collis-Brown propeller of 20 inches diameter and 3 feet pitch was employed. The speed of the screw was reduced to 350 revolutions, while the motors revolved at 950 revolutions per minute. In later experiments the dynamos were replaced by one D_2 Siemens machine, which was directly connected to the screw; and more recently Messrs. Yarrow & Co., in conjunction with the Electrical Power Storage Company, fitted up an electrical launch destined for the Vienna Exhibition. The boat was 40 feet long, with 6 feet beam, and could carry forty passengers. The motor was a Siemens machine, which developed seven horse-power. During the trial the speed of the boat, which was over eight miles, could be varied by a communicator which threw more or less cells in operation.

Sir W. Siemens said from his knowledge of the behavior of these launches, they promised excellent results. The question was, What was the secondary battery going to do for us? Was it going to last, or was it a perishable institution? In order to test the question quickly, he put down secondary batteries in his own house last autumn. He charged them by means of a very small half horse-power engine, and the result so far had been very satisfactory. He had lighted his house by the small engine with the aid of the secondary battery with great effect, using forty incandescent lamps from half-past seven in the evening until one or two o'clock. He started his engine at eight o'clock in the morning, and in the evening he had a sufficient accumulation of energy in the battery to last the length of time it was required. In the case of the launch, the machine could not be taken with it, and the battery would occasionally have to be charged. Therefore he would limit the application of the electric power to navigation of short stages. The cost of the use of steam power and electric storage would be about equal; but the latter would give advantages in weight and space.

Electric Resistance of Rarefied Air.

Professor Edland has communicated an important paper to the Royal Academy of Science, Sweden, in which he adduces further proof of his discovery that a perfect vacuum is a good conductor of electricity. This result is directly opposed to the current doctrine that a vacuum is a perfect insulator. The reason why a Torricellian vacuum is not traversed by an electric current is due to the fact that there exists at the points of the electrodes an obstacle to the discharge of the current, and this obstacle is augmented as the air is rarefied. If the current could be introduced into the vacuum without electrodes it would be able to pass through the void without difficulty. The conclusion he arrives at from his recent laborate experiments is that the maximums attained by this current intensity at a certain pressure of the air when a current traverses a rarefied air-space is not due in any way, as generally assumed, to the resistance between the electrodes by the air having its minimum at that pressure, and afterwards increasing in amount with the increase of rarefaction, but to the fact that the sum of the electromotive of the spark and this resistance then possesses its minimum value. With the continuation of the rarefaction the resistance of the column of gas diminishes; but the electromotive force increases. Without employing electrodes at all, M. Edland can by induction easily excite luminous effects in a gas sufficiently rarefied to stop the passage of a powerful current from electrodes. But this would in his opinion be impossible if a highly rarefied gas were an insulator.—*Engineering, London.*

The Consolidated Electric Light Company Increasing Its Plant in Portland.

The Consolidated Electric Light Company have been notified that the two twenty-five light dynamos, recently ordered by them, are on their way, also fifty new lamps. This increases the capacity of the Portland station fifty per cent., and enables the company to fill orders already in hand, amounting to twenty-five lights in addition to those now in use.

This increase of the plant will also result beneficially to the lights already in use, inasmuch as the station is now running to its fullest possible capacity, and in fact a few more lights have been run than is ordinarily used in connection with a station the size of Portland's. The company immediately ordered two more machines, believing their Portland business will require this additional plant by the time their order can be filled.

The territory lighted by electricity in Buffalo, N. Y., is about to be extended by the addition of nearly eleven new miles of line.

The Baxter Electric Lamp.

A reporter for the REVIEW called upon Mr. William Baxter, Jr., at No. 120 Liberty Street, to get a description of his improved electric lamp, and was furnished with all the information in Mr. Baxter's possession. He was asked when his lamp was first put into operation, and answered: "Seeing the popularity of the electric light all over the country, and knowing that in its present form as commonly used the expense is too great to compete successfully with gas, I determined to do what I could to reduce its cost. My experiments were successful, and last January I put the first lamps in use in Jersey City; so they have been running now about ten months, and giving perfect satisfaction."

"How many have you now in use there?"

"The men in authority have been putting them in until now there are about sixty in use lighting the streets."

"What are the features of economy in your lamp?"

"The economic points consist in the saving of carbons and dispensing with the service of one lamp trimmer. Taking as a standard a plant of 100 lights, we find that with our lamps, we can dispense with the services of one lamp trimmer, thus saving two dollars a day. The ordinary lamps for the same number of lights would require three hundred carbons, while with our lamp fifty carbons would answer the same purpose, thus making a daily saving of $18.75 on this number of lamps. For all-night work this invention does away with the necessity for double lamps. One of our lamps will run three nights in succession."

"What style of carbon do you use?"

"We use the same stick carbon as other electric lamps. This attachment has been applied to four different styles of arc lamps with perfect success, and is applicable to all styles of arc lamps. By reference to the figure, at the top is the regulator casing, and to the bottom of this is attached the connecting trunk, with a slip joint between them, so that the carbon rod will move easy, and be practically, though not absolutely, air-tight. Attached to the bottom of this trunk is the glass receiver; at the connecting joint is asbestos packing, and the two are fastened with bevel-pointed screws that force the glass globe against the packing, so as to render the globe perfectly air-tight. We have several methods of making this attachment. These glass globes are ten and twelve inches in diameter and thirteen inches high. When the light starts, it instantly burns up the oxygen, and the small percentage of carbonic oxide and nitrogen gas that remains will not support combustion, thus answering the purpose of a vacuum."

"Have you patented your improvement?"

"I have lately had a patent allowed covering the practical application of the principle upon which this improvement works, and have several others pending which cover various modifications."

"What other advantages has your lamp over the old style?"

"Being enclosed air-tight, the wind and rain cannot affect them, and owing to the same air-tight feature this lamp can be used by divers in deep water, where it is too dark to see how to work. Being perfectly inclosed and insulated, it is safe for life and property. This invention saves one-half the entire cost of electric lighting by arc lights. It gives more light from the same amount of electric energy; it makes a steadier and purer light, is more reliable, is not affected by stormy weather, and can be used with perfect safety in oil refineries and similar places, where any other arc light would be exceedingly dangerous."

"Will you be able to compete with gas companies with your lamp?"

"This improvement is applicable to any form of arc lamps, and any company adopting it can compete successfully with gas, which will consequently give a new impetus to the introduction of electric lighting, and make it a permanent and profitable business."

"What comparative proportion of electricity and carbons does it use?"

"By reference to the cut, it will be seen that the carbons are placed within an air-tight globe. This prevents combustion, so that the only consumption is that due to the action of the electric current, and is less than one-sixth of what it is in the ordinary lamps. We have had these lamps in service for ten months, and one set of carbons that in ordinary lamps last half a night, in these lamps last from three to four nights, burning all night long."

"You hope with this invention to bring electric lighting into more general use?"

"By means of this improvement it will be possible to furnish electric light as cheap as gas and still make a large profit. This will result in its being much more extensively used, and will thereby make the business of the local companies profitable."

Kalamein.

THE NEW PROCESS OF IRON PRESERVING.

Kalamein is a newly discovered compound metal, which, when applied to iron or steel, gives it an appearance similar to galvanizing, and at the same time renders it thoroughly non-corrosive and impervious to acid, moisture or atmospheric influence. It is not the invention of Mr. Henry Roberts, as stated in yesterday's paper, but of a New York chemist. It is claimed to be not simply an external coating, but a chemical alloy, which enters into the body of the metal treated by it, and works a change in its very nature.

The great difficulty with which galvanizers have to contend is the deteriorating effect of the molten zinc upon iron. To use an old galvanizer's phrase, it appears to "burn the very life out of it." The action of kalamein is directly the reverse. It is said to soften and toughen the metal to which it is applied, and will unite with planished steel as readily as with the ordinary grades of iron. Another remarkable property of the metal is that it will withstand the effects of fire. Iron coated with it can be heated red-hot without injury to the coating. A well-known manufacturer of this city—one of the promoters of the present enterprise—happened to see the process in operation during the past summer in Wolverhampton, England, where it has been successfully worked for several years. He was so impressed with its value that he immediately wrote to his business associates

here to secure the right to use it if possible.

It is entirely probable that Pittsburgh will be the center of this new and important industry. Messrs. Everson, Macrum & Co. have been using the process for some time in the treatment of sheet iron, and the National Tube Works Company, having recently purchased the right for pipes and tubing, are operating in their immense works at McKeesport with wonderful success. The Oliver & Roberts Wire Company, the most extensive galvanizers of wire in America, are just beginning to use it, and expect before long to substitute it for galvanizing. The firm of H. P. Scott & Co., Limited, also propose to use the process in the treatment of their barb wire and ribbon fencing. Negotiations are also pending for the sale of rights to other large manufacturers in this vicinity.

The company will immediately enter upon active business, with their principal office in Pittsburgh, and a branch office in New York. They expect both to manufacture the alloy and sell the right to use it for different articles.

Produce Exchange Clock.

ONE OF THE LARGEST TIME-PIECES IN AMERICA.

The clock which is intended for the tower of the new Produce Exchange building and is nearing completion, is regarded as one of the most remarkable time-pieces in this country. The machinery is mounted upon pillars of fine steel, set in a framework of cast iron. Instead of the old "dead beat" escapement, a far more nicely adjusted combination of machinery is employed. It is the new gravity escapement. The pendulum is thorough in compensation, being constructed of nine parts, four of brass and five of steel. It is a two-second pendulum, taking two seconds for its swing or beat.

At the lower end of the pendulum is suspended a weight of 500 pounds, inclosed in a heavy brass cup. The length of the pendulum rod is about fourteen feet. The pendulum is hung upon very delicate steel springs, and its movements are made with the utmost precision.

The six-legged gravity escapement is connected with the pendulum, by simple yet delicate mechanism, and all its acting parts are jeweled. By this escapement the motion is communicated to the pendulum. On each side of the pendulum rod is an iron arm suspended from one end obliquely; as the escapement wheel turns, small pins on its axis raise the free end of one of these arms by means of levers. As the pendulum reaches the termination of its path, the arm is released, and its weight, pressing against the pendulum, drives it to the other side, where the operation is repeated. The motion is carried to the four dials above by a revolving iron rod.

There is an electric attachment to the clock by which any number of dials may be run all over the building. An automatic retaining power permits the clock to be wound without interfering in the least with its continuous action. In the ordinary large clocks it is necessary to shift the gearing and go to a great deal of trouble to set the hands; in this clock there are sixty holes in the brass wheel attached to the main shaft. By withdrawing the pin which makes the connection, the whole machinery can be whirled with ease and rapidity in either direction. The small dial in front also enables the operator to judge exactly when to stop. The hands are so weighted that they cannot be affected by the weather, however severe a storm may prevail. Mr. E. Howard, the maker, said that the cost of the tower clock alone is $2,000, with $3,000 extra for attached electrical clocks in different rooms in the building, making the total cost $5,000.

Electrical omnibuses, the invention of M. Philippart, recently traveled from the Place de Nations, Paris, to Versailles, a distance of more than twenty kilometers. There was no serious hitch on the trials. Only one time there was a stoppage, owing to the heating of a coil by excess of current, but the delay did not take up much time.

On a New and Very Simple Electro-Dynamometer for Very Feeble Alternating Currents.

BY M. BELLATI.

The needle of a galvanometer is replaced by a horizontal piece of soft iron wire, which, when at rest, hangs perpendicular to the magnetic meridian. If the coils of the multiplier form with the meridian an angle of 45°, the wire is temporarily magnetized by currents passed through it, and attempts to place itself at right angles to the plane of the coils, whatever may be the direction of the currents. In an instrument in which, instead of the iron wire, there was suspended a bundle of well-annealed iron wires 0.15 mm. in thickness and 17 mm. in length, fitted with a mirror and suspended by a thread 10 cm. in length in a multiplier 35 mm. in width, with a layer 8 mm. in thickness of copper wire 0.2 mm. in thickness, good results were obtained.

In producing telephonic currents by means of the trumpet of Siemens, there was produced a deviation which could not be measured, as the image went beyond the scale. The deviation was perceptible with a gentle voice at the distance of 50 cm. from the telephone.

Sin and Electricity

Charles Dudley Warner has the following in a paper in *Harper's Monthly*:

We know that it is usually held nowadays that crime is either hereditary, or caused by badly cooked food, poor clothes and unwholesome lodgings; at any rate, it is a disease, with little personal responsibility, caused by something akin to malaria, and to be cured by physical treatment. The so-called criminal should be pitied rather than punished. If a man is properly nurtured he will be pure. It is so well settled that when an exception occurs in the case of a well nurtured man or woman who steals, we put the action out of the catalogue of crimes by calling it kleptomania. And the proof of this is that no poor and shabby person has ever been known to have kleptomania. We are accustomed also to trace other delinquencies to like causes. We know that certain views of life and moral duly, called by their authors systems of philosophy, are due to dyspepsia. We have recently had Carlyle explained by a diagnosis of his stomach made by Mrs. Carlyle and Mr. Froude. We can tell the cause of most of our latter-day poetry; we say at a glance that such a poem came from the undercrust of a pie, and that another one is the result of anæmia, and that another has the sentiment of gin, and that others show a clogged state of the biliary duct. A proper course of medical treatment would cure most of these.

This is, as they say of evolution, a very pretty working theory for philanthropists, but it does not altogether satisfy us. Does it account for the suicides, of which there has been an epidemic in 1883? Or for the eccentric conduct of so many women, which is reported in our daily newspapers? Or for the moral condition of what is called fast and high society in London and New York and Bucharest? Not satisfactorily. But there is an agency which covers the whole like a mantle. We do not say that sin is merely perverted electricity, but we do say in all our observation of mankind it never before acted as it has done since the sun spots turned up. There may have always been spots on the sun; perhaps there has, as there has always been more or less wickedness around, but we have been very slow to see the connection between the two. We can now, by the light of electricity itself, so to speak, observe the close relation of electric disturbances to moral disorders. If there is anything in the theory, when we have electric storms we ought not only to look out for atmospheric disasters, shipwrecks, tidal waves, earthquakes, and for collisions and railways and steamboat catastrophes, which are directly caused by human stupidity and carelessness, but also for an excess of mental disorders, crimes and eccentricities. People are probably moved to suicide and a general violation of the decalogue (we refer to the old one, and not to the Shapira revision) by electricity. The moral electric conductors of the system are disturbed. Under such a disturbance some are made ill. Some fly to poetry, some steal, some slander, some run off with other people's husbands. This of course. But the question is, are we always controlled in our action by this subtle fluid, even when there is no unusual display of it? For instance, is "affinity" electricity? We have not space here to pursue the subject, which our readers will see has infinite relations to human life.

But assuming the physical, mental and moral interference of electricity with human beings, and that it is as much the cause of crime as it is of virtue—the latter resulting, of course, from a well regulated electricity—there is a practical suggestion to be made. Instead of coddling criminals, as we should do if they are simply unfortunate victims of disease, we ought to treat them by electricity. Police courts ought to be provided with electrometers, or whatever machine it is, for measuring the quantity of electric fluid in an object, and put those arraigned to a scientific test, not for the purpose of punishment, but of cure. A bad man is merely an overcharged thunder cloud. Of course he is dangerous. He ought to be shut up until his electrical condition is made normal. We can not afford to run the risk of being struck by his lightning. And our gaols and penitentiaries ought to be under charge of electricians. We want, in short, to apply electricity to moral diseases as we do to physical, and no one can tell what wonders may be wrought. The treatment can always be adjusted to the condition of the subject. The electrician can strike some of them with lightning at once and end all. Or he can give just the right charge to induce a flow of virtue through the heart. It must be matter of experiment for a good while. But if the system works well in prisons, a still wider field is opened outside for this moral agency. Perhaps those characters known as "dangerous women" are merely the subjects of electric disturbance. All they need is the battery to become sweet ornaments of society. If this theory is sound, a glorious prospect is before us. What could not a skillful electrician do in Congress and in our State legislatures? A new era will dawn when we can rectify moral evil as easily as we can whisper the tones of endearment into a beloved, delicate, pink ear fifty miles from our lips.

The English Electric Railroad.

On the electric railroad recently opened by Lord Spencer, with a large number of eminent scientists, between Portrush and Bushmills, England, the electricity, generated at a waterfall on the River Bush, and conveyed to the end of the line by an underground cable, is carried along through a conducting rail, which is supported on insulators at some distance above the ground. An arm, with a brush or pad at the end of it, stretches out from the train and keeps contact with this conductor. But on the day when the Lord Lieutenant came to "inaugurate" the line it was suddenly found that there was a serious hitch. The engine declined to draw the car. The machinery was in perfect order, the connection with the conductor was all right, and yet there was no motion. Horror filled the souls of the public-spirited promoters of the first electric line in the United Kingdom. It was discovered, happily before much time had been lost, that somebody had readered progress impossible by the simple expedient of driving a piece of iron from the electric rail into the bank at the side, so that the current was being absorbed into the earth as fast as it was transmitted from the Bush. The iron being removed, the viceregal party made a successful trip.

The Local Manager on the Western Union Ownership of Stock.

To the Editor of the Commercial:

LOUISVILLE, Oct. 28.—Your leading editorial of this morning seems to be intended to contradict the statement of Mr. J. B. Speed and myself, to the effect that the Western Union Telegraph Company had no stock in either the Ohio Valley Telephone Company or the Bell Telephone Company.

As you publish the following extract from the report of assets of the Western Union Telegraph Company:

	No. of Shares.	Value.
Southern Bell Telephone stock	1,687	$250,000 00
American Speaking Telephone Co.'s stock.	12,075	1,811,250 00
Metropolitan Telephone stock	4,000	1,200,000 00
Bell Telephone Co., of Philadelphia, stock	2,500	250,000 00
Southern Bell Telephone and Telegraph Co.'s stock	1,887	283,050 00
Telephone Co., of Detroit, stocks	7,430	371,500 00
Delaware and Atlantic Telephone Co. stock.	200	20,000 00
Commercial Telephone Co., of Troy, stock	1,011	101,100 00
Commercial Telephone Co., of Albany, stock.	92	27,600 00
Bell Telephone Co., of Canada	372	37,200 00
Total	31,254	$1,251,700 00

and then ask some one to rise and explain the seeming contradiction, we accept your invitation, and trust, as a matter of justice, that you will give this article the benefit of your columns. No explanation is really necessary, for by referring to the list which you publish you will see it does not embrace a single share of American Bell Telephone Company or Ohio Valley Telephone Company stock, so your extract from the report of the Western Union Telegraph Company simply confirms our statement.

To explain further, we would state that the American Bell Telephone Company, whose general office is in Boston, owns all the valid telephone patents in the United States, and its business is manufacturing and leasing instruments.

The several companies mentioned in the above quoted list, as well as the Ohio Valley Telephone Company in this city, are separate and distinct corporations, controlling more or less territory in different parts of the country, under license from the said American Bell Telephone Company, which company leases to the various local companies the instruments necessary to operate their business. Because the Western Union Telegraph Company owns stock in some of the local companies, it by no means follows that it has any control in the affairs of the American Bell Telephone Company. If it did, it would soon close our offices at Frankfort, Shelbyville, Madison, and other points where we are now competing with them for business.

The district telegraph companies you refer to operate a system of call boxes and messengers, and have no more connection with the telephone business than a livery stable has.

Concerning the Brooks cables, there are two distinct patterns. The one the Western Union Telegraph Company is interested in is a submarine or ocean cable.

The other is manufactured by the Western Electric Company, of Chicago, and is the pattern which we have under the drawbridge.

It is nothing but a gas-pipe, in which cotton-wound wires are placed, after which it is filled with coal oil and sealed up. It can only be worked a limited distance, and is wholly useless for general street purposes, for to open it to make any change or addition of wires would flood the street with coal oil. It is now entirely superseded by the Day, Lytle, Phillips and Patterson cables.

H. N. GIFFORD,
Gen'l Man'g O. V. Tel. Co.

Telegraphic.

Annual Report of the President of the Western Union Telegraph Company for the Year Ending June 30, 1883—Approved by the Executive Committee.

To the Stockholders:

CAPITAL STOCK.

The capital stock of the company is $80,000,000, of which $20,172.50 belongs to and is in the treasury of the company. A small portion of the capital stock is still represented by certificates of indebtedness in the hands of the Union Trust Company, in trust for the parties entitled thereto.

BONDED DEBT.

The bonded debt at the close of the year was as follows:

Bonds due March 1, 1900, 6 per cent	$931,176 00
Bonds due May 1, 1900, 7 per cent	3,920,000 00
Bonds due May 1, 1902, 7 per cent	1,373,000 00
	$6,224,176 00
Less balance of sinking fund appropriations not yet used for redemption of bonds held by the Union Trust Company trustees	259,971 90
	$5,964,204 10

During the year sterling bonds, due March 1, 1900, to the amount of £2,100, were redeemed by the trustees of the Sinking Fund.

BUSINESS OF THE YEAR.

Surplus July 1, 1882		$1,664,240 13
The revenues, expenses and profits of the year ended June 30, 1883, were as follows:		
Revenues	$19,454,902 98	
Expenses (including leased line rentals and taxes)	11,794,553 40	
		$7,660,349 58
		$9,324,589 71
From which there was applied:		
For dividends	$5,199,124 05	
For interest on bonds	426,817 83	
For Sinking Fund appropriations	40,094 00	
		$5,636,065 88
Deducting which leaves surplus June 30, 1883, of		$3,658,553 83
Represented as follows:		
Surplus of net revenue for the year over dividends, interest and Sinking Fund appropriations		$1,994,313 70
Surplus at commencement of year, as above		$1,664,240 13
		$3,658,553 83

Summing up in round numbers, the net earnings for the year were $7,660,000, out of which $467,000 were paid for interest and Sinking Fund on bonded debt, and $5,199,000 in dividends to stockholders, leaving $1,994,000 (nearly two millions) of excess above dividends and fixed charges to be added to the surplus before accumulated.

During the past year the Mutual Union Telegraph Company has been absorbed by lease, the rental agreed to be paid being the interest on five millions of dollars in outstanding bonds, and a sum equal to one and a half per cent. per annum on its capital stock of ten millions of dollars. This transaction was followed by the usual vexatious litigations and injunctions, involving extraordinary expenditures of over three hundred thousand dollars, from being compelled under the restraining order of court to operate that company separately for some months after its absorption. But for these unforeseen elements in the business of the year the profits for the year would have reached eight millions of dollars, as estimated in the last annual report.

GENERAL STATEMENT.

The following exhibit shows the revenues and disbursements of the company for seventeen years from July 1, 1866:

Surplus of income account, July 1, 1866	$275,357 24	
Net revenues for seventeen years, from July 1, 1866, to June 30, 1883	65,769,301 28	
Making an aggregate, June 30, 1883, of		66,044,658 52
During this period there was applied:		
For cash dividends to stockholders (including dividend payable July 16, 1883)	33,531,524 80	
For cost of 59,606¼ shares of Western Union Telegraph stock, purchased and owned by the company, which was distributed to stockholders in 1879	3,302,198 90	
For cost of 72,010 shares of Atlantic and Pacific Telegraph stock, purchased and owned by the company, the proceeds of which in Western Union stock were distributed to stockholders in 1881	1,806,250 00	
For interest paid on company's bonds	6,728,380 32	
For cost of 396 4¼-100 shares of Western Union stock, purchased and owned by the company, which were cancelled to make the capital stock, after the issue of the new stock in 1881, exactly $80,000,000	26,836 00	
For amount reserved for interest on bonds and for Sinking Funds, accrued to June 30, but then not yet due and payable	106,086 64	
		$45,501,276 66
Leaving a surplus of		$20,543,381 86
Which is represented as follows:		
Construction of new lines, erection of additional wires, patents, etc	$9,293,356 48	
Purchase of telegraph lines, and of stocks of companies leased by the Western Union Company, upon which interest or dividends are paid as rental	2,500,794 17	
Gold and Stock Telegraph Company's stock (28,905 shares)	1,176 000 00	
International Ocean Telegraph Company's stock (15,170 shares)	961,606 42	
Brooks Underground Telegraph Company's stock (1,000 shares)	95,000 00	
Southern Bell Telephone and Telegraph Company's stock (1,687 shares)	84,325 00	
Sundry other stocks and bonds	103,749 86	
Western Union bonds, redeemed and cancelled	1,369,813 69	
Sinking (Funds portion not yet used for redemption of bonds exclusive of interest allowed by trustees	230,755 40	
Broadway & Dey Street building	$2,340,639 52	
Less amount provided from the proceeds of the bonds	1,802,202 00	
	538,437 52	
Real estate, other than above	348,790 41	
Supplies and material on hand unissued	182,290 08	
Surplus June 30, 1883	3,658,553 83	
		20,553,381 86
On account of these assets, a stock distribution was declared in 1881 to the amount of		15,526,590 00
Deducting which leaves a balance of		$5,016,791 86

The assets which have been purchased and paid for out of the net revenues are stated in the foregoing schedule at their cost value.

The company has other large and valuable assets, which were not purchased and paid for at a fixed price, but which were taken over under contracts with the several companies absorbed by lease or amalgamation, and which, therefore, had no specific cost value at which they could be entered into the general accounts of the company. These are included in the following *list of marketable assets in the treasury* of the company, June 30, 1883, with their marketable value as nearly as can be ascertained:

Marketable Securities.	Number of Shares.	Par Value.	Marketable Value.
Gold and Stock Telegraph Co.'s stock	19,438	$1,943,800.00	$1,749,420.00
Gold and Stock Telegraph Co. of California, stock	3,010	301,000.00	451,500.00
Gold and Stock Telegraph Co.'s bonds	.....	65,300.00	65,300.00
International Ocean Telegraph Co.'s stock	16,231	1,623,100.00	1,541,945.00
Philadelphia Local Telegraph Co.'s stock	12,000	300,000.00	600,000.00
Dominion Telegraph Co.'s stock	5,766	288,300.00	288,300.00
Western Union Telegraph Co.'s stock	201	20,100.00	16,080.00
Brooks Underground Telegraph Co.'s stock	1,000	100,000.00	95,000.00
American District Telegraph Co., of New York, stock	2,614	261,400.00	130,700.00
District Telegraph Co., of Boston, stock	7,023	175,575.00	117,050.00
American District Telegraph Co., of Baltimore, stock	9,000	45,000 00	22,500.00
American Speaking Telephone Co.'s stock	12,075	1,207,500.00	1,811,250.00
Metropolitan Telephone and Telegraph Co.'s stock	4,000	400,000.00	1,200,000.00
Bell Telephone Co., of Philadelphia, stock	2,500	125,000.00	250,000.00
Southern Bell Telephone and Telegraph Co.'s stock	1,887	188,700.00	283,050.00
Telephone and Telegraph Construction Co., of Detroit, stock	7,430	185,750.00	371,500.00
Central District and Printing Telegraph Co., of Pittsburgh, stock	1,360	136,000.00	272,000.00
Delaware and Atlantic Telephone and Telegraph Co.'s stock	200	20,000.00	20,000.00
Commercial Telephone Co., of Troy, stock	1,011	25,275.00	101,100.00
Commercial Telephone Co., of Albany, stock	92	9,200 20	27,600.00
Bell Telephone Co., of Canada, stock	372	37,200.00	37,200.00
Northern Pacific R. R. Co.'s preferred stock	90	9,000.00	5,490.00
Anglo-American Telegraph Co.'s stock and other miscellaneous securities in small lots, consisting of telegraph and railroad stocks, bonds and scrip	.....	.....	566,069.74
			$10,023,054.74

Most of these securities have greatly appreciated in value during the past year; and many of them are likely to command even a much greater value in the near future.

The foregoing list does not embrace the large amount of stocks held by this company in telegraph companies whose lines have been leased by this company, and the greater part, and in most instances the entire stocks, subsequently purchased, and the telegraph properties substantially merged into the Western Union system. Among these may be enumerated $3,963,300 of the stock of the old American Company; $643,500 of the Atlantic and Ohio; $2,381,600 of the California State; $125,000 of the Chicago and Mississippi; $629,000 of the Franklin; $100,350 of the Illinois and Mississippi; $1,457,500 of the Pacific and Atlantic; $390,475 of the Southern and Atlantic; $119,755 of the Vermont and Boston; $530,550 of the Washington and New Orleans; $1,000,000 of the South-Western; $204,400 of the Missouri and Western; and miscellaneous stocks of sundry smaller companies, of more than $1,000,000, amounting altogether to over $12,550,000.

The stocks of the United States Company, $6,000,000; the Atlantic and Pacific, $14,000,000; and the American Union, $10,000,000, and $5,000,000 bonds of the latter company, which were directly capitalized into this company, by the issue of its stock in exchange therefor, are, of course, not marketable assets, and therefore, not included in either list.

These together aggregate nearly sixty millions of stocks and bonds of other companies, including those that have been absorbed by this company since the beginning of 1866, besides over twelve millions in money expended in the direct construction of new lines.

The past year does not exhibit any lagging in the race of progress. It exhibits an increase of 13,234 miles of line, or about 10 per cent.; and of 58,358 miles of wire, being 15½ per cent. over the previous year; while the earnings show an increase of $2,340,937.06, or about 14 per cent., and the net profits an increase of $542,279.58, or about 8 per cent. over the year preceding.

The increase of $1,798,457.58, being 18 per cent, in the gross expenditures, is because of rentals paid for the American cables, the Cuba cables, and the Gold and Stock Telegraph Company (all the rentals paid by the company being charged in current expenditures), while these rentals were paid for only a small portion of the preceding year.

The percentage of cost of operating the land lines of the company has been steadily reduced.

The company is pursuing the policy of steadily reducing the rates to the public, and has extended the rate of 25 cents per message to and from New York City, until that rate covers a larger area than is embraced in the whole of Great Britain.

The net earnings for the year were over nine per cent. on the capital stock above fixed charges, and this the management believe will be considerably increased for the current year.

The vexatious litigation to which the company has been subjected during the last three years is substantially and satisfactorily terminated by the late unanimous decision of the Court of Appeals, sustaining the legality and good faith of the contracts and of the stock dividend in 1881, and of the acts of the directors in respect thereto. It only remains to be seen how far the authors of these malicious proceedings can be made answerable to the company for loss and damages it has thereby sustained.

Respectfully submitted.

NORVIN GREEN,
President.

The Postal Telegraph.

WASHINGTON.—The recent publications of the Post-office Department showing the number of letters transmitted by the mails show that the average number of letters written by every man, woman and child in the country is about twenty-five yearly. The average in England is about forty apiece, while Scotland's average is also ahead of ours. In Ireland, however, the average is only sixteen apiece. The British mails last year carried a billion and a half of letters, and that was only a part of the British postal service, which included telegraph and savings banks. The statistics of the British system will be anxiously sought here this winter, for they will be made a text for the argument to be pressed in favor of the postal telegraph system for this country.

The success of the Armington & Sims Company engine is leading to numerous infringements. The Armington & Sims Company have published a notice that they will sue any party infringing on them, and they have the money to back it up.

Telephonic.

Returns by Telephone.

Mr. Abbett, the Governor-elect, received at his residence in Jersey City, Wednesday night, the election returns by telephone, from the Jersey City Telephone Exchange, from all parts of the State. Fifteen operators were at work, and the task required the utmost exertions of the entire force until nearly 12 o'clock, when Gen. Barney, the Superintendent, was able to send out the closing bulletin, announcing the majority and the result of the election upon the Legislature. These returns were received at Jersey City, and sent to all exchanges and pay stations in the division, and the telephone company is congratulated upon their public spirit and enterprise as news gatherers and distributors. So does the world progress in the matter of intercommunication of intelligence. We remember when the method of collecting and distributing election returns by mail gave way to the employment of special couriers; these in turn were superseded by the telegraph, and now the telephone is called into requisition to meet the demands of this fast age.

Had any one asserted a few years ago that a gubernatorial candidate could receive complete returns through the medium of the human voice, while seated in his own residence, and afterward receive the congratulations of his friends and supporters in distant sections of the State, by personal conversation with them at their residence, he would have been regarded as a fit candidate for the lunatic asylum. Yet this was done by the Governor-elect at his home Wednesday night.

The Bell Telephone in Europe.

The directors of the International Bell Telephone Company (limited) have prepared a statement of the business and condition of the company, in which they say the capital stock is 17,000 shares, of the par value of $100, of which 3,130 shares are held by the Central Trust Company of New York in trust, to be exchanged when presented for $313,000 six per cent. convertible bonds sold at par for cash. The debt of the company is the above bonds and a floating debt of about $125,000 advanced by bankers. The managers in Europe ask for further remittances of $75,000 before January 1, to prosecute the work. The assets of the company consist of patent rights, &c., for the telephone in Belgium, Germany, Austria, Italy, Spain, Portugal, and Russia, with rights and good-will in the invention in Sweden, Norway, and Holland. The company owns lines and exchanges in Norway with 900 paying subscribers. In Russia, with 1,447 paying subscribers; exchanges of nominal value in Italy, besides a stock interest in other companies in the above countries of the par value of $670,750, and $40,000 in the Bell Telephone Manufacturing Company of Antwerp, which is doing a large business. The number of subscribers to the above exchanges July 1, 1883, was 9,647, a gain of 1,944 since October 1, 1882. The company has been actively engaged in construction from its organization, and the extension of its lines has always required the outlay of more than its receipts from business. The gross receipts from January 1, 1883, to June 30 were $124,855.79, of which $82,071.64 properly belonged to that period. The running expenses were $37,250.43, making the net earnings $44,821.21. The directors expect larger receipts for the balance of this year, and especially for the year 1884, when the Pelgian and Italian Companies and the Bell Telephone manufacturing companies are to begin paying dividends. A fusion has been made between the companies at Milan, Genoa, and Turin and the Société Italienne, a wealthy French company, having exchanges in the same cities, which ends competition. The company expects to fund the floating debt and begin paying dividends in 1884.

7 Council-House Street,
Calcutta, Hindostan, October 2, 1883.

Editor Electrical Review:

Dear Sir:

Since I last wrote you, our International Exposition buildings have been gradually advancing towards completion. With the exception of the carriage department, the superstructures are nearly finished, merely wanting the painting and whitewashing. There is still a great deal to be done to the flooring; but floor-ramming, in this country, where the force exercised by the rammer only equals the weight of the coolie who drives it—which is infinitesimal—plus the weight of the rammer—which is a light, wooden one—must always be a slow process to do well, and when the ceaseless wear and tear of thousands of feet passing over in almost an unbroken stream for twelve hours a day for five months has to be considered and provided for, the floor becomes a matter of great importane. I am glad to hear that the promenade is to be laid down with Portland cement. The exhibits will be in the center, and the promenade on each side; an arrangement which secures the largest amount of exposing space, as the pyramidal style can be carried to any height the nature of the goods permit of.

The Australians have evidently taken up the exposition very heartily, from the frequent notices and allusions to be found in all the leading Australian newspapers. The first shipment of exhibits left Melbourne on 4th current, and should reach here about the 20th inst. As well as the exhibits, she brings us a heavy consignment of barmaids, who have been most carefully selected with a view of outdoing England in this special branch of trade, which is likely to become a very large one.

The firm of Walsh, Lovett & Co., of Birmingham, England, will exhibit a small portable railway running round the east side of the machinery shed; also a couple of very light and simple iron bridges of about 30 feet span.

They are also agents of the London firm of Stiff & Co., to whom, with other manufacturers of the same class, we owe the improved appearance of the public buildings lately erected here, as they are the manufacturers of the neat and often elegant *terra cotta* castings which form the capitals of the pillars, the facings of the keystones of the arches, the ornamental band which surrounds the windows and doorways, cornices, &c., and all those parts where, in Europe and America, ornamental stone work is used. They will show the large castings of agriculture, which is intended for the new Treasury building, and which, I hear, is to be a great eyesore to the Europeans, as in the group of figures the native Indians are made to be much finer men in every respect than the former.

The game of billiards will be well represented, as, besides our local manufacturers, the leading English firms are sending some of their very best work in billiard tables.

A good deal of interest has been excited among the local wine merchants and wine consumers on the subject of Australian wines.

The general opinion of both experts and connoiseurs here is that the Australian wines hitherto offered for sale in Calcutta were too new and too alcoholic, and that they only required keeping to remove all objections, as the quality and body were extremely good; but nothing can give that mellowness so much prized except age. Not even burnt sugar will do it properly, and so I hear we are to be shown some of the oldest wines in Australia. I only hope we shall be allowed to taste them, too, and that they will bring plenty, as we are awfully thirsty dogs here.

As far as I have been able to make out, we are to have only the antiquated gas to light our way while treading the flowery mazes of the exhibition at night, and I think it is a very poor compliment to the East for no good company to have come forward to show us some of the wonders that are daily being accomplished by learning and experience.

No more now from yours respectfully,

F. Osborne.

"The Telegraph Lineman."

by J. A.

Cold, bitter cold, the snow flies fast,
All nature chilled by winter's blast;
A struggling form through blinding snow,
Fatigued with toil, yet on must go.

A duty that he must perform,
Compels him still to breast the storm;
Upon his labors more depends
Than human nature comprehends.

The wires "crossed" and "grounded" are
That caused the instruments to jar;
While telegrams both "red" and "black,"
Are piled up in a mighty stack.

It may be death, it may be life,
Or freedom from some worldly strife;
We know not what a word implies,
As swiftly o'er the wire it flies.

To banks and brokers, those who shave
Thousands perhaps to gain or save;
If but a message could get through
To post their friends on points anew.

And as they sit around the fire
Discussing the intricate wire,
No thought is given to the form
That battles boldly with the storm.

For many miles he has watched the lines,
At last the mystery he finds:
A joyful prayer he whispers low,
To know no further he must go.

And now the messages fly o'er
The mystic wire as before:
The banker's face assumes a smile,
The broker, innocence beguile.

Yet such is life; some men grow rich
By those who labor in the ditch,
Without a word to cheer their way,
While toiling on from day to day.

Notes from Jamaica, W.I.

Kingston, October 31, 1883

November fast approaches, when Kingston will again be thrown into a feverish state of excitement, consequent upon the assembling of the all but defunct Legislative Council, when a little over half million of pounds will be voted away by those forming the Council, which might be better known as the "Official Oligarchy." It is not certain whether the present administrator, Major-General Gamble, will preside in Council or not, as General Sir Henry Wylie Norman, K.C.B., C.I.E., has been appointed to the governorship, and, as rumor has it, will arrive in time to take his seat as president of the Council. A public meeting is to be held denouncing the passing of the budget. It will be remembered that when the British Government forced the passing of half the damages in the "Florence" case the unofficial members resigned in a body, and to this day the Council consists of nothing but paid officials.

Jamaica anxiously awaits the report of the Royal Commissioners, who arrived here in January last. It is said that they have submitted their report, and that it is even printed. Very probably the new governor will be able to throw some light upon the matter, many think he will be entrusted with bringing out with him the report and its expected changes.

The Bishops of Antigua, Trinidad, British Guiana, Nassau, and Barbados, with the Bishop of Jamaica, will hold a conference here sometime in November. It is also expected that Bishop Holly, of Hayti, will be among them.

Since the fire of the 11th December last, when upwards of six hundred places, comprising dwelling-houses, stores, wharves, and the two Jewish places of worship, fell a prey to the devouring element, a general rebuilding movement on an improved scale has taken place, and instead of the unsightly and unsymmetrical buildings which existed before the fire, there are now being erected structures that will at once strike the architectural eye; yet it is feared that a good portion of the westward part of the city will still retain the character which the fire gave it, except the Government come to the rescue of the owners. There is in course of preparation a bill for the purpose of raising the money, which is expected to form a part of the work of the coming Legislative Council

The exodus to Colon is still large; besides the regular bi-monthly trip of the Royal Mail steamers there are a good many other steamers and sailing craft that takes away laborers. This promises to shake the planters. A meeting has been held by the landowners, for the purpose of devising means to settle the difficulty, but nothing definite has been settled upon.

W. D. B.

EDUCATION BY TELEPHONE.

The German Students Discover a Means of Taking Science and Beer at the same time.

CONNECTING THE LECTURE HALL WITH THE BEER GARDEN—A HAPPY THOUGHT—LISTENING TO THE HERR PROFFSSOR—PREVIOUS METHODS OF HEARING LECTURES IN THE GERMAN UNIVERSITIES—ONE MAN DELEGATED TO HEAR THE LECTURES—DEFECTS OF THIS SYSTEM—MAN LIKELY TO GO TO SLEEP OR DOSE—SOMETIMES NOT IN INTELLECTUAL CONDITION FAVORABLE TO THE CONSIDERATION OF ABSTRACT SUBJECTS—CHARACTER OF THE GERMAN LECTURE—DANGEROUS WORDS—ARE THIRTEEN SYLLABLE WORDS DANGEROUS TO LIFE?—THEOLOGY BY TELEPHONE.

The Germans being the first thinkers in the world, we are never surprised when some new philosophical discovery or some development of principles already known, is heralded from the Geman land.

Unusually, however, these discoveries are of a somewhat theoretical nature, and can only be appreciated by the learned. It is, therefore, a pleasant surprise to learn that the Germans have discovered a new use for the telephone; a use, by the way, that will commend itself alike to the student, the professor and the keeper of the public-house.

In plain terms, it consists in joining the lecture-room and the beer-cellar by telephone, and thus enables the student, who is usually as thirsty for beer as he is thirsty for knowledge, to save the valuable time which heretofore has been wasted in going to and returning from lectures.

Various have been the attempts that from time to time have been made by ingenious students to devise a means of profiting from the lecture without being forced to attend it; but, up to the present, it may be said not one of these plans has given entire satisfaction.

At the German Universities—Heidelburg, Göttingen, Bonn-on-the-Rhine, and Berlin especially—what may be called the usage, so far as lectures are concerned, has been for a number of students to get together and appoint one of their number a delegate to a certain leeture. Sometimes a class would choose delegates tor a week. In this way, instead of sixty or seventy young men rushing to a lecture, two solitary figures, the one the class delegate, the other the professor, would at the ring of the bell, wend their way towards the lecture-room. Thus, a professor suddenly looking up from his notes, and not noticing the scantiness of his audience was once known to have begun with "Gentlemen," and then—the solitary audience having coughed to assert its indivisibility—corrected himself, and began again with "Sir."

When the lecture was finished, the man delegated to hear it hurried back to the *Studentenkneipr*, where his classmates usually gathered, and told them all he had been able to gather of the Herr Professor's lecture. But this plan, though the best devised up to the present time, has some serious defects. The man to whose lot fell the duty of hearing the lecture did not always turn up in time to do his whole duty—the too liberal libations of the previous night's corps meeting, or some other of the pleasures and dissipations to which the period included between the sun's setting and rising is usually dedicated in student's life, would serve not infrequently to detain him even if he were in a condition favorable to intellectual investigations. Thus the professor would have only four walls and a lot of empty chairs to talk to, and eloquent appeals in support of Kant or Malthus, stirring addresses on the Pleurotomidæ of Senegambia, on the Mollusca of the Caucasus, on the nervous system of the ringworm, on the development of the diaphragm and pericardium, on the hyperelliptic functions in mathematics, and the like themes, are lost to the student and to the world.

This much for the condition of things before the advent of the telephone system as applied to lectures.

In the subjoined cut the new system is

graphically depicted. The student is no longer dependent upon what a single man may chance to hear of his lecture. A man who has been up all night at a ball, though he be responsible to sixty or a hundred of his mates, may go to sleep in the middle of a lecture or doze all through it; his legs may possess the strength to take him safely to the lecture, and his mind not be in a condition to comprehend it when he gets there. The delegate may—indeed, it has not infrequently happened—get the incoherent utterances of those he met at the midnight supper mixed up with what he heard the professor say during his lucid moments, and thus his classmates get some extraordinary ideas of the particular subject of which the lecture was an elucidation.

But when every man of them has a telephone to his ear, and hears for himself every word the Herr Professor utters, all such things are impossible.

Again, as will be seen by a reference to the picture, the festivities of student life may know no cessation from morn till dewy eve, from eve till twilight.

The keeper of this public house—to speak more particularly, *studentenkneipe*—has had his beer cellar connected by telephone with the various lecture rooms, and the studious young men who are his guests are dutifully listening to every word the Herr Professor is saying. One of the number, as will be seen, though he wants some more beer, will not hazard the loss of a single word by putting aside the instrument in order to ask for the bev erage. Instead of doing this, he mutely waves his mug aloft with one hand, while he holds the telephone faithfully to his ear with the other, pre ferring to attract the attention of the *Kellner* to his wants by means of various facial contortions than break in by rude exclamations upon one of the well-rounded sentences of the lecturer. Near by is another student who has hit upon the happy idea of listening to a scientific discourse, while at the same time pouring into the not unwilling ear of the fair barmaid a somewhat liberal supply of that saccharine but innutritious article known in the idium of our own Bowery as "taffy." This is the very apex of scientific accomplishment, this the very acme of economy of time and labor. And what is this that these young men are listening to with such interest? It is a lecture on Political Science, and should you put your ear to the telephone you would hear frequent repetitions of such ponderous phrases as *Freundshaftsbezeigungen, Dilletantenaufdringlichkeiten, Staatterordnetenversammlungen, Alterthumswissenschaften, Kinderbewahrungsanstalten, Unabhangigkeitserklaerungen, Wiederherstellungsbestrebungen, Waffenstillstandsunterhandlungen, Generalstaatsverordnetenversammlungen.* The effect of such words on those not accustomed to them—American and English students—is often of a serious nature, especially when the listener tries to memorize them; and in a lecture room where beverages of a refreshing and bracing nature are not at hand, cases of continued stupor are by no means unknown. Under the present system, however, all this is changed; the patients—that is to say, the students—since they take in the lecture and exhilarating beer at the same time, are not likely to be overpowered.

Indeed, it would be well if the Herr Professors should give their lectures in beer-halls, for they have, at times, been known to succumb and fall victims to their own ponderous language. Thus, an eminent traveler has given us this note out of his memorandum book: "July 1—In the hospital, yesterday, a word of thirteen syllables was successfully removed from a patient—a North German from Hamburg—supposed to be a professor; but as, most unfortunately, the surgeons had opened him in the wrong place, under the impression that he contained a panorama, he died. The sad event has cast a gloom over the whole community."

The idea so happily hit upon by the German students of being educated by telephone, has by no means been thoroughly developed as yet. Before long, no doubt, telephones will be made to connect the students' rooms with the chapel, and thus the most slothful, the most unrepentant, may be given a fair start on the road to theological perfection. There are those, doubtless, who will be inclined to find fault with this idea. But let them answer if compulsory religious instruction is not better than none at all, and remember that the midnight reveler rarely turns up in chapel in the morning, though the neglect so to do counts against him at the end of the *Semester*. We once knew of one of these who, being called to account by the president of the faculty, responded, "Well, professor, if you'd have prayers at four o'clock in the morning, or if you'd have them at four o'clock in the afternoon, you could count on my being there; but you have prayers at nine o'clock in the morning, and at that time I'm right in the middle of my first nap!"

EDUCATION BY TELEPHONE.

MEXICO CITY, Oct. 23rd, 1883.

Editor Electrical Review:

MY DEAR SIR:

Mr. A. G. Haines, General Manager and Proprietor of the Oaxaca Telephone and Telegraph Company, has arrived at this capital for a short visit to see his brothers D. S. & I. D. Haines, who are also largely interested on telephone and electrical work in this republic.

Mr. A. G. reports the telephone system to have been a grand success in the State of Oaxaca, the birthplace of ex-president Porfirio Diaz.

Mr. Haines has connected with the central office all the government public offices, merchants, lawyers, doctors and a number of private residences. Mr. A G. Haines is an energetic young man, and in the short time he has been in Oaxaca, has, by hard labor, connected with the capital, the Districts of Timatlan, Ejutla, Ocotlan and Etla, the inhabitants of Oaxaca are more able to day to talk at a distance of seventy-five miles through the most perfect line that we have in the republic

We wish to Mr. Haines a happy and safe return to Oaxaca. M. W. Y.

Description of the Cable Laid in Washington.

The Standard Underground Cable Company have commenced laying their cables in Washington, and will extend them to the different parts of the city as designated in their permit granted by the commissioners on the 9th of October. Their intention is to lay at present about four and three-fourth miles of cable, with wires for three telephone lines and two Morse telegraph lines for the use of the United States and District governments. Twenty men are at present employed in doing the work. The superintendent says the average will be about a thousand feet each day. With the force of men they now have the work will be completed in a week or ten days.

The cables are the same as have been in use on trial in Pittsburgh for eighteen months past, known as the Warring cable. They consist of six copper wires, bound tightly with cotton thread, and saturated with ozite, said to be the best insulating substance known, and encased in a lead cable about an inch and a quarter in diameter. Each wire is separated from the rest by a thick lead coating, so that they can, in no way, interfere with each other. The cables are made at the company's factories in Pittsburgh, and the process is very simple, two men being all the force necessary to manufacture it. The wires are conducted through a mould so arranged that they will not touch each other, and lead is poured around them and subjected to a pressure of 3,000 pounds to the square inch. This pressure forces the liquid lead around and between the wires, forming the cable. As many as twenty-five wires have thus been united in one cable, and an unlimited number might be so combined.

The instrument used in testing the wires is a Thomas Reflecting Galvanometer, such as is used in transmitting messages across the Atlantic cable, and is attached to the end of the cable in the vaults of the Capitol.

This instrument, Mr. Van Hoevenberg, the electrician in charge, says, is so delicate that if there were the least imperfection in the cable at any point it would be at once discovered, however remote or small the defect might be. To illustrate this he placed one hand on the wire and one on the lead surrounding it, and the needle of the instrument became dreadfully agitated. "This cable," he said, "is perfectly sound and will never need to be disturbed after it is laid. It will last indefinitely—I believe a thousand years.

"It cannot be injured unless some one cuts it."

Telephone Stock Quotations.

American Bell Telephone Company	209
Bay State Telephone Company	123
Central New York Telephone and Telegraph Company	101
Boston and Northern Telephone Company	135
Empire State Telephone and Telegraph Company	200
Granite State Telephone Company	95
Hudson River Telephone and Telegraph Company	100
Long Island and New Jersey Telephone Company	100
Mexican Telephone Company	2½
National Bell Telephone Company of Maine	90
New York and Pennsylvania Telephone Company	97
Northwestern Telephone Company	100
Southwestern Telephone Company	68
Suburban Telephone Company	139
Southern Bell Telephone and Telegraph Company	125
Tropical Telephone Company	1½
Central Union Telephone Company	100
Iowa Union " "	100
Missouri and Kansas Telephone Co.	90
United Telephone Company (Kansas and Missouri)	89
Bell Telephone Company, of Missouri	165
Wisconsin Telephone Company	125
Cumberland Telephone Company	100
Great Southern Telephone Company	100
Michigan Telephone Company	115
Chicago Telephone Company	285
Erie Telephone Company	59

Electrical Review.

The above is the title of a weekly journal of electric light, telephone, telegraph and scientific progress, published at New York City—George Worthington, editor; Thomas H. Delano, publisher. The REVIEW is an illustrated journal, and in its general appearance is surpassed by no periodical in America. It is a sixteen page paper, and its subscription price is $3.00 per annum.

As this is termed the "Electrical Age," and the REVIEW is recognized authority among American electricians, this paper may be styled the leading scientific journal of the day.

While its appearance at once indicates taste and mechanical skill, its able editorial management is its greatest attraction. The information imparted in this paper is invaluable to every electrician, and no telephone official or employe can afford to be without the REVIEW.

During our attendance at the recent National Telephone Convention, at Cincinnati, we had the pleasure of meeting Mr. Worthington and Mr. Delano, and have only to say, that as the rays of an electric light peer through the shades of night, so the real personnel of these gentlemen are reflected through the columns of the ELECTRICAL REVIEW.—*The Telephone, York, Pa.*

The Pullman Palace Car Company will declare the regular quarterly dividend of 2 per cent., with an extra dividend of 1¼ per cent., both payable November 15. It is said that the net earnings of the company for the year ended August 31, were about 19 per cent., and since August 31 the earnings show a gain of over $3,000 per day.

A Northern tourist, engaged in looking up the title to some Texas lands, was sitting in his room at the hotel. A colored waiter came in with some clean towels. "What kind of weather is there outside?" inquired the man. "Is it raining?" "Yas, sah," answered the waiter. "De fac' is, mos' all de weather we has in Texas is on de outside. We doan git much wedder on de inside, dat is, no hebby wedder."—*Texas Siftings.*

Electrical Review,

FORMERLY REVIEW OF THE

Telegraph and Telephone.

Published Weekly at 23 Park Row.

P. O. BOX 3329.

GEO. WORTHINGTON, Editor. THOS. H. DELANO, Publisher.

SUBSCRIPTION.

United States and Canada, $3 00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

ADVERTISING.

Transient rate, 25c. per line each insertion.

"Business specials," 35c. a line.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Those desiring to recommend their goods can do so to any extent in our advertising columns, but we will not publish for pay anything of that nature in our reading columns.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

The Proprietors do not hold themselves responsible for opinions expressed by their correspondents.

No notice is taken of anonymous communications.

FOREIGN AGENTS OF THIS JOURNAL,

From whom copies of the paper can be procured.

The Montreal News Company, Montreal, Canada.
The Toronto News Company, Toronto, Ontario, Canada.
Wm. Dawson & Sons, London, England.
H A. Kramers & Son, Rotterdam, Holland.
Berthold Mendel, Berlin, Germany.
F. D. Osborne, Calcutta, East India.
F. Knauff, Moscow, Russia.
Otto Maass, Vienna, Austria.

NEW YORK, NOVEMBER 15, 1883.

CONTENTS.

	PAGE
Applications of Electricity on Railroads	1, 2
Electric Railway News	2, 3, 4
Electrical Storage Batteries	3
The Consolidated Electric Light Company, of Portland	3
The Baxter Electric Lamp	3
Kalemein	3
The Produce Exchange Clock	4
Sin and Electricity	4
Telegraphic Items	4, 5, 9
Telephonic "	6, 7
Education by Telephone	7
Annual Report of Western Union Telegraph Company	5
Protecting Cables	8
Electrolysis in Manufacturing	8
One-Sided Criticism	8, 9
The Consolidated Electric Light Company of New York	9
The Commercial Telegram Company	9
Letters to the Editor	
The Rhode Island Electric Company's System of Lighting	9, 10
Electrical Patents, &c., &c	10

Protecting the Cables.

Few persons besides those familiar with the character of the dangers to which submarine cables are subject, can appreciate the importance of the convention signed by the cable conference last week in Paris. Since the laying of the first cable, up to the present time, when a string of cables join us with Europe, little or no government assistance has been given the companies in protecting their property from vicious or careless persons.

To M. Cochery, the French Minister of Postes and Telegraphs, belongs the credit of having brought the matter intelligently before his government, and the action which the latter has shown an inclination to take, is likely to be followed by other countries.

M. Cochery believes that the convention entered into for the protection of submarine cables will be sanctioned by treaties within three months.

So far as the protection of cables during time of war is concerned, it was very wisely decided to leave the subject for diplomatic discussion.

The convention will apply outside of territorial waters to all submarine cables legally laid which touch the land in the territories of the contracting parties. The latter bind themselves, when authorizing the landing of cables, to impose conditions for their protection. Laying or repairing ships must obey the rules to avoid fouling. The tribunals competent to deal with infractions of the convention will be those of the country to which the ship in fault belongs.

It is by no means singular that France has taken the lead in the very important work of protecting the cables, and in showing an example of how much needless expense a little forethought will save. The French intellect is not only quick to perceive but quick to act. We have been dozing over this matter for years, knowing its importance, but never rising to the point of action. We have seen cables torn asunder through the recklessness or carelessness of mariners, and an anchor, worth perhaps fifty dollars saved at an expense to the cable company of perhaps fifty thousand dollars.

Notwithstanding the invaluable service they perform, the cable companies have been left to look out for themselves. They have tried to protect their property, but with little success.

The Gloucester fishermen and the Canadian fishermen, who anchor on the Grand Banks, have been promised full pay for the loss of anchors which have been found to be a-foul of the cables, but many, especially the Canadians, continue to haul away at their anchors, and thus the cables are being continually torn asunder.

Under government protection, with heavy penalties for breaking a cable, all this would be changed. However stubborn and malicious a skipper might be, he would, under such circumstances, hesitate before cutting a cable that had got twisted about his anchor; for, with a crew of from twenty to forty men, there would surely be found some who could be relied upon to inform on him when port was reached, especially if a handsome reward was offered.

We hope M. Cochery, the French Minister of Posts and Telegraphs, will carry this matter of government protection to a successful practical termination.

Electrolysis in Manufacturing.

In the manufacture of the finest qualities of textile fabrics, the French may safely be said to surpass all others. This may, no doubt, be attributed to two especial characteristics. First, a superior artistic sense; and, second, a readiness to try new methods and to experiment with new devices.

News now reaches us that a manufacturer in Lyons has made a novel application of electricity with the most gratifying results. The chemical telegraph has for some time been the only useful application of the staining or discoloring effects of a current of electricity. The ribbon of paper on the chemical systems of telegraphy is saturated with certain chemicals, and when the current passes through the paper the solution is reduced and a blue stain is made on the paper. M. Mathiot used printing-blocks in place of the needle point used in the telegraphic instruments, and has printed designs, letters, and patterns on cloth and paper by electrolysis. From the experiments made, it appears that the fabric is impregnated with a solution of aniline salt, and is then placed on a metal plate that is connected by wire with a dynamo machine.

Another plate, containing the lettering or pattern in relief, to be produced on the paper, is also connected with the dynamo; the two plates forming a circuit. When the printing plate is laid on the paper, under some pressure, the circuit is closed and the current passes from one plate to the other through the paper, the salt is reduced, leaving a permanent stain in aniline black in the exact form of the type or pattern on the paper. By substituting a carbon pencil, held in the hand by an insulated sleeve or handle, writing in black can be traced on the paper by means of the current.

This last plan is thought to be likely to prove of great value, as the markings are in indelible black, or in a number of other permanent tints. Another plan is to use engraved rolls that form a part of the electrical circuit, and to pass the fabric between them while the current is passing. By a reversal of the system bleaching has been accomplished. Fabrics dyed indigo blue, or Turkey red, impregnated with a solution of saltpetre, have been bleached out white by passing them between rolls that are in an electrical circuit, or under a press having type or a raised pattern and in a circuit. Whenever the current passes the color is destroyed, leaving the fabric white. In passing such a press, the colored fabric has a pattern picked out in white upon it. The process, both in printing in black or colors and in bleaching dyed fabrics, is believed to promise a method of producing printed, or more properly stained, fabrics of great sharpness and clearness of design and in new shades of color.

The march of electricity in many directions is certainly surprising. There seems to be no limit to its application. Almost every day we hear of some new discovery in applied science by which this force is utilized.

One-Sided Criticism.

Our reduced contemporary, the New York *Times*, continues its ill-advised and unfair attack upon the voltaic arc companies. Those who remember the *Times* when John Foord was practically at its head, must be disgusted with its course now. Up to six months ago it was noted for its broad views, its sterling common sense, and, above all, for its love of fair play.

We knew John Foord, and we know he never permitted a one-sided story to appear in the columns of the *Times* if the other party to the controversy was willing to tell his side of the story. But now that he is gone there seems to be no one at the wheel the hulk no longer keeps on the same course, but turns first this way and then that way. The *Tribune*, its powerful rival, has, it is said, made heavy inroads into its circulation recently, and, with a view of regaining its lost ground, it proposes to play the rôle of reformer. It has set out on a crusade against all worldly evils, save those which exist in its own domain, or which, if attacked, would injuriously affect its own circulation. It has no stomach for battle with such abuses.

If the voltaic arc people advertised in the *Times*, we can assure them they would be free from attack.

Now, we do not wish to be understood as saying that a criticism of any system of electric lighting constitutes an attack. By no means. Criticisms will do these systems more good than harm, and any system which cannot stand the light of day must, of a necessity, be defective. But we will leave it to any intelligent man if the views of only those who are hostile to a certain electric lighting system, who, indeed, are rivals in the same business, like those interviewed by the *Times* reporter, ought, in fair play, to be printed, without giving those whose systems are criticised an opportunity to be heard. This is a direct violation of the very first principles of metropolitan journalism. Look into the columns of such respectable journals as the *Tribune*, *Sun*, *Herald* and *World;* and in every case where you see a damaging criticism of a company, a system or an individual, you will find that both sides have at least had the offer of a hearing.

In the case we have cited, the *Times* sent a reporter to interview Mr. Edison on the voltaic arc system and the secondary battery.

Now, Mr. Edison has an incandescent system, and the voltaic arc is a rival system.

Again, his most dangerous rival in the incandescent field is the Brush Company, which uses the Swan lamps, and this company is now engaged in putting in lamps and storage batteries to work in conjunction therewith.

We will put these questions to any fair-minded man: Is Mr. Edison, under these circumstances, the proper man to go to for an impartial criticism? and, having made his statement, should not the voltaic arc people have been given a hearing?

In our last week's number, we pointed out some curious errors in the *Times'* first article. All electricians will support us in the assertion that firemen have nothing to fear so far as throwing water across voltaic arc wire is concerned. The water will not, as the *Times* informant alleges, conduct the current to the man holding the hose, but to the ground, for the very good reason that the human body offers a greater resistance to the passage of the current than does the water.

He has nothing to fear from touching a water-pipe affixed to a building, for the pipe offering a less resistance to the passage of the current than the human body, the latter will not serve to deflect it.

Of the interviews had with the firemen in last Sunday's *Times* we have nothing to say, for the statements contained therein were made by men who do not understand the technical points involved, but, naturally enough, get their impressions from the previous exaggerations of the *Times* on the same subject.

Only a few weeks ago, when the *Times* reduced its price to two cents, we congratulated its readers upon getting so much good reading as it formerly contained for half what they had been in the habit of paying. But it seems that in reducing its price it has reduced its standard of decency and reduced the quality of the matter supplied, while its powerful and brilliant rival, the New York *Tribune*, has pursued the contrary course. Though reducing its price to three cents, it still retains its high standard. No man or body of men can be accused by the *Tribune* without having an opportunity to answer, and we dare say, whether or not, a company advertised or not in the *Tribune*, it would have little or no effect upon its treatment.

Besides giving our own opinion of the charges made by the *Times* against the voltaic arc system, we wrote to Mr. C. J. H. Woodbury, the inspector of electric lights for the Boston Fire Underwriters' Union, who, as may be inferred, is one of the very best authorities in this country on this subject. Here is his reply:

To the Editor of the Electrical Review:

SIR:

Your favor of 5th inst. is at hand with enclosures. The author of the articles withholds a portion of the truth, either through purpose or ignorance. No single contact can direct the electricity from a lighting circuit. The first contact is generally formed by a connection to the earth, and persons cannot be injured by touching any electric system except their bodies form a portion of a circuit. If they are on an insulated stand of any kind, they can handle any electric lighting apparatus *with one hand* with impunity; keep the other hand in the pocket in such cases.

A man attending to aerial wires is in infinitely more danger from gravity than elec-

tricity. If the electric lighting systems were faithfully kept free from the earth by an insulation of say 7,000 ohms in damp weathers, and also trespassers would let the apparatus alone, there would be an end to these deplorable casualties.

The fires in Philadelphia, cited in this article, were caused by sparks dropping from carbons.

The electrical resistance of a large stream of water, which of course leads from the earth, is so small that the amount of current diverted through the body of a fireman would be inappreciable.

There are dangers and difficulties connected with electric lighting, as with the transfer of all kinds of energy, but they are of an unusually easily preventable nature in comparison with the difficulties met in conducting steam and water under pressure.

Whoever prepared the article in the *Times* did not act in good faith, if provided with a full knowledge of the facts in the case.

Yours truly,

C. J. H. Woodbury.

In the address before the Franklin Institute, Mr. Woodbury explained the matters under discussion with great clearness. He said that the difficulties connected with the introduction of the electric light have been inseparable with the use of a new form of energy, for the currents have been so much greater than those hitherto used that their application was virtually a new science. Twenty years after illuminating gas was known the architect of the House of Commons specified that no wood-work should approach within six inches of a gas-pipe.

Whenever, says Mr. Woodbury, an electric-lighting current has been diverted from the system, it has generally given unwelcome evidence of its energy. Such occurrences, considered as an accidental loss of energy, are comparable to the bursting of a boiler or the yielding of a dam; but there is no chance of such extensive injuries to life and property from any mishaps resulting from the use of electric-lighting apparatus.

Wherever the use of a large amount of power is involved, the safety is dependent upon the facility with which the whole is held under control, whether it be the head of water against the water-wheel, the steam in the boiler, or the electricity in the circuit. The experience with the electric light is showing that these currents are more easily controlled than other forms of energy, as far as any elements of danger are concerned.

It is not necessary at this time, says Mr. Woodbury, to recount any of the fires caused by electric lighting, but I am not aware of a single fire of this nature which, in the light of present knowledge upon the subject, is not to be considered as a preventible fire. With proper and *continual* attention to insulation, construction of lamps and of switches, and in the incandescent system also the proper size of conducting wires and *closed* safety catches, there can be so little opportunity for fire from electric lights that, under these conditions, it forms the safest method of illumination.

Most of the fires and other difficulties with electric-lighting apparatus have been caused by the diversion of the current from the system at distant points, each leading to the earth, and very few accidents due to a conductor making a cross between two adjacent wires. Two contacts are required in order to form the complete circuit necessary to establish an electric current. If a single conductor leads to the earth, only a second one is necessary to divert a portion of the current from the system to the earth, the relative quantities of the current seeking the two paths being inversely proportional to their electrical resistances of the conductors.

Such a diversion of the electricity causes first the commercial loss of electricity. If the contacts are of a nature to diminish the resistance of the circuit, then there is great liability of injury to the armature or commutator in most dynamo machines. The fires have been produced where the electricity met with a conductor of sufficiently high resistance to convert the electricity into heat whose temperature is high enough to burn any combustible substance.

The instances usually occurred on a circuit where one ground connection already existed, and a stream of water leaking during storms, or from washing floors, running over the wires and to the earth formed a good conductor, which was soon removed, as the electricity dissociated the water, and then an arc was formed as the current strove to maintain itself. Pure rain water is a very poor conductor of electricity, but, in trickling over plaster or whitewash, it takes enough lime or salt into solution to increase its conductivity many times. In some instances, the water connected two wires of different potential. We see the same action when the current is let on an arc lighting system. When the carbons touch, there is little resistance, and would be no light if the feeding apparatus was not arranged so as to draw the carbons apart and thus present the resistance of the space of the distance between the two carbons.

To all fair minded people who are neither engaged in keeping a reduced newspaper on its feet nor tooting a rival system of electric lighting, it will suffice to say that the voltaic arc system of lighting is yet in its short-clothes.

Able men are now engaged in correcting these defects from which a new and complex system is never free. They are making gratifying progress, but, being only human beings, cannot be expected to perform miracles, and hence occasional slips and mishaps will occur, and these should not be looked upon as condemning a system which has given many evidences of efficiency.

An army of reputable men, and millions of capital, are embarked in voltaic arc enterprises throughout this country and Europe, and we shall be very much astonished if the feeble wail of a rival or the warning quack of a reduced and disappointed newspaper will suffice to frighten the one, or lessen the inflow of the other.

The Consolidated Electric Light Company.

The plans for the operation of this company are now well developed and the future outlook is decidedly encouraging. It is their purpose to manufacture the whole apparatus for an electric light plant under what is known as the Sawyer-Man system. The company have fifty-one United States patents, the first of which is dated August 14, 1877, and the last June 6, 1882. Most of these patents are the inventions of W. and E. Sawyer and Albon Man, with the inventions of other less prolific inventors, all of which have been assigned to the Consolidated Electric Light Company. This company was organized under the laws of the State of New York on September 8th, 188', with the object of purchasing the above mentioned patents, to manufacture electric lighting apparatus for both arc and incandescent systems, and to do a general electric lighting business. Experiencing some trouble in the beginning which has prevented them from doing up to date much more than get strongly organized, investigate and substantiate the proof of their several patents, and get their factory in complete running order, they are now, however, ready to put in plants of any desirable magnitude and into any place where an isolated plant is wanted. Their business will be confined to lighting large buildings, and even blocks when necessary, with either or both of their systems; and propose, like several companies in this and other cities, to sell outright the apparatus completing their system direct to owners or individuals who will operate these isolated plants themselves, the company ceasing to have anything further to do with them after the purchase has been made, except furnishing further apparatus when needed. There are now in operation two plants; the first consists of 100 incandescent lamps and machinery which has been in successful operation at the New York wood-turning companies' factory in Harlem. The second plant fitted up with this system was the whole of the United Bank building, corner of Wall Street and Broadway, which has a capacity of 400 16 candle power lamps. The company have selected one of the best engine companies in this country to furnish engines for all their plants, and in doing so have shown a desire to have the best power attainable to run their dynamo machines. They will equip all their plants as they have this one with Westinghouse engines, and, beside the one of 400 horse power that runs the dynamos in the United Bank building, have ordered four for their newest and largest plant which is to go into the magnificent building now being erected for the Mutual Life Insurance Company on Nassau Street. This will be the largest instalment of machinery yet put in by this company, and will consist of four 50 horse power Westinghouse engines, each of which will run two dynamos. These eight machines will furnish current 1500-16 candle and 10-125 candle power lamps. The contractors who are now constructing the building intend to work nights, and one engine with the necessary machinery will be put in place at once, to furnish lights for the workmen. This building is one of the largest in New York, and by securing the contract for putting up a plant of sufficient quality and magnitude to light it thoroughly, the company should be congratulated. Beside laying their own wires they will put in those of every other character which will be used for electrical purposes.

Commercial Telegram Company.

Commercial Telegram Company's tickers put in operation in New York Stock Exchange, November 1, prove themselves equal to every demand so far made upon them, giving the quotations on the tape at a rate of speed fully one-third greater than has ever been done prior to their introduction; and the company claims to be able to increase present speed fully 50 per cent. when necessary; have so far kept fully up with the market and the instruments standing idle at least one-third of the time. Brokers say they have never before had so perfect a service. The enterprise and push of the new company having even spurred the old company to something approaching a fair rate of speed. In the offices where the new and the old instruments were working side by side, groups of interested brokers and operators were watching them closely, and it was evident that the sympathies of the majority were with the new candidate for public favor. It was generally conceded that the new company had fulfilled its pledges to give the public a better—because a more rapid—service, and even with the increased speed of the old instrument, the new was able to outtravel it. This, too, in the face of the fact that the Commercial Company's reporters, operators and instruments were all new and inexperienced as compared with those of the old company. If the Commercial can keep its recorded quotations up with the market on the first day of its service, what may not be expected of it after a month of practice?

In appearance the new instruments are not very unlike the old, though they are smaller and apparently more simple in construction, are mounted upon finely finished French walnut, pedestals of an octagonal shape, and are an ornament to the finest office. Being almost noiseless, they are preferable where quiet is desired.

Brokers on the exchange very generally expressed their satisfaction with their working, and the company, as a consequence, is kept busy putting in new instruments for exchange members.

A visit to the Welles Building, 18 Broadway, where the working machinery of the Commercial Telegram Co. is located, amply repays the sight-seeker. Here in the basement and top story of this magnificent building are the operating, engine, supply, test and storerooms of the company. Three steam-engines are used to drive the six large dynamos which generate the electricity necessary for running the tickers in the various offices and business houses throughout the city. All these dynamos are not in use at the same time, some being held in reserve in case of need. Hundreds of instruments fresh from the factories, walnut pedestals, glass hades, boxes of paper, tape and other adjuncts of the business, are to be found in the spacious storerooms; while in the operating room, which is brilliantly lighted by incandescent lamps, nimble-fingered young ladies and gentlemen are to be found in charge of the instruments holding converse with the outside world.

The evident success of the company's instruments in New York has created a demand for their introduction in other cities, and already strong local companies, backed by well-known bankers and business men, are being organized in Philadelphia, Boston and Providence, and the factories of the Commercial Telegram Company in New York are now running day and night with extra men turning out the plant necessary for use in these cities. It is expected that operations will begin in these cities on or about the first of the new year.

Flattering offers have been made for the right to operate the Commercial Telegram Company's instruments in Chicago and other Western cities, and it is understood that prominent and practical parties are at present negotiating with a view to secure a large portion of the Western territory.

Altogether, the new company shows every evidence of thrift and stability, and promises to prove a phenomenal success, even in this age of rapid successes.

Blacksville, W. Va., Oct. 23, 1883.

Editor Electrical Review:

Dear Sir:

Will you kindly solve the following vexatious questions for me?

I have two (2) electro-magnets of 12 ohms resistance attached to a battery of six ordinary telegraph office jars. I attached an electric bell of a two-inch gong to the current, and found that the bell would not ring when the armature was drawn to the magnets, and that the armature would not be attracted to the magnet when the bell was ringing (the bell was a vibrating one).

1st. Is it that the current is not sufficient? 2d. Or is it that the magnets are of too great a resistance for the magnet in the bell? 3d. Or is it impossible to attach a vibrating bell and, at the same time, keep the armature to the magnet?

And oblige, yours truly,

L. A. Lincoln.

ANSWER:

Some two or three years ago Dr. Van der Weyde, of this city, made a series of experiments with galvanometric measurements, intended to determine the influence of iron cores of various forms, constructions, and dimensions placed in conducting spiral coils, upon the induced or secondary currents developed in the coils at the making and breaking of the contact admitting the primary or battery current. It is known that at the making of the contact an instantaneous current in opposite direction is induced in any coil conducting the current, which therefore momentarily counteracts the battery current at the first moment of its formation. It is also known that the force of this secondary current, very weak in an empty coil, is increased by the insertion of an iron core; but Dr. Van der Weyde found that when using a horseshoe-form electro magnet, it is still more increased by the closing of the armature, so as to form, as it were, a complete magnetic circuit or circle, passing through both coils. He found that in the latter case the secondary current may be made fully equal, and even stronger than the first; and, therefore, the two currents may be made to neutralize one another. He came to the conclusion that, therefore, an electro magnet with iron core, when placed in the same circuit with vibrating armature, may be so arranged as to prevent their proper operation, and he carried this out practically, not only by closing the armature, but by simply placing a piece of iron in an empty coil, and withdrawing the same. At the withdrawal the vibrating alarm will sound; when the iron is inserted it will stop.

It appears that our correspondent accidentally had the conditions fulfilled which did show this interesting peculiarity, and in

answer to his first question it may be said that, if he increases the current the induced current will also increase in the same proportion. So this would not correct the trouble.

Secondly—Decreasing the number of windings of the magnet will diminish the disturbing secondary current, and also diminish the resistance to the primary current, of which, therefore, more current will reach the alarm bell, and will correct the trouble.

Thirdly—It is possible to attach a vibrating armature, and at the same time keep the armature of the magnet closed. It can be done in two ways: First, as suggested, by having on the closed electro-magnet not too many windings, or have the vibrating armature operated by a stronger magnet; secondly, by dividing the battery current in multiple arc, one separate current going through the vibrator, and another separate circuit through the gong magnet. In this case, however, the two resistances must be balanced in such a way that the current will divide itself according to the needs of the two electro-magnets, which is easily done by inserting additional resistance in one of the two circuits, keeping in view that currents will always subdivide themselves exactly in the inverse ratio to the resistances to be overcome.—Ed.

Editor Electrical Review:

1. Is the light, heat and consumption of carbon in the arc-light the result of combustion in any degree, or is it *perfect* combustion?

2. Will the electric spark jump a break between terminals in a perfect vacuum, *i.e.*, with no gas or other substance in place of the atmosphere in the tube?

Please answer through your excellent paper. Vernon Bell.

Minneapolis.

ANSWER:

1. The light and heat of the electric arc is not produced by perfect combustion, not even the result of combustion; it is no combustion at all. It is simply caused by the resistance which the electric current experiences, in passing the space between the carbon points. This resistance changes the electrical force or motion into that other mode of motion which we call heat and light, in the same way that heat and even light may be produced when any kind of rapid motion of heavy bodies is impeded by collision or friction. It is true that the carbons are gradually consumed, but when placed in a vacuum they will not be consumed; in fact this is the original way that the first electric carbon light was produced eighty years ago, because at that time wood charcoal was used for this purpose, which, in the air, burned away very rapidly; while the more resistant gas coal carbons of the present day were at that time an unknown material.

Other conductors, such as metallic points, may also produce electric arc light; they will, however, be differently colored by the particles volatilized as a result of the great heat of the arc when it leaps over the space between the conductors; this takes place with the carbons also, and all that this carbon vapor does is to color the light a purer white than is the case with most other substances. How the current carries these particles from one carbon to the other may be beautifully shown when the arc light is placed in the spot where the painted slide of a magic lantern is placed for projecting the image against the wall or a screen. This ocular demonstration settles the matter, that whatever slight combustion of the carbon accompanies the arc light, it has very little to do with the great intensity of the light produced. It is the very high temperature produced by the current which is the cause of the intensity of the light which can not be produced by any combustion, except, perhaps, by that of phosphorus in pure oxygen gas.

2. The electric spark cannot jump a break when the vacuum is very near perfection. Such a vacuum is made by filling a tube with carbonic acid gas, exhausting it by a Sprengel mercurial air pump, to about one-millionth of the ordinary atmospheric pressure (which makes it about one-eighth of a grain to the square inch), and then let the small remnant of this gas be absorbed by caustic potash enclosed in the tube. After this has been done, sparks intense enough to jump along the outside of the tube through the air, cannot pass between the terminals of the two platinum wires inserted inside, even when their distance is as small as the eighth of an inch, showing that the true vacuum is an impenetrable barrier to electrical conduction, and proving that the electric transmission is not that of a fluid, but, like sound, a peculiar mode of motion of material particles. If electricity were a fluid, the conductivity would increase with the perfection of the vacuum, because the air is to be considered as a resistance, and exhaustion reduces this resistance, as proved by the old fashioned Aurora tubes, and the modern Geisler tubes. But this experiment proves that when there is nothing left to transmit the peculiar motion, which we call electricity, the transmission is at an end; like the common experiment with the air pump shows that when there is not air enough left to transmit the vibratory motion which we call sound its transmission ceases, and we hear nothing, while we see the bell strike under the bell jar receiver, the sound reappearing when the air is again admitted. In the same way the electric spark will appear again as soon as the least particle of air gains access. This is beautifully proved by heating that end of the tube containing the potash; the heat drives out some carbonic acid gas, and the spark passes; when letting the tube cool, the potash absorbs again the gas, and the impenetrable barrier is re-established.—Ed.

The Maxim Incandescent Light in R. I.

The following letter gives some information of interest relative to the cost of lighting mills with the incandescent system of electric lights furnished by the Rhode Island Electric Lighting Company, of Providence, R. I.:

Olneyville, R. I., Oct. 20, 1883.

Messrs. Rhode Island Electric Lighting Co., Providence:

Gentlemen.—In accordance with your request, we give you below the result of our experience with the Maxim Incandescent Light.

On the third day of April last, we started one of your Weston dynamos, running one hundred Maxim Incandescent Lamps, and April 30th, an additional fifty-light machine. Our shop is a one-story weave shed, containing 260 cotton looms, with attachments for fancy and Jacquard weaving, running on white work day and night, an average of 280 hours per month of lighting time throughout the year, or 243½ hours per month for the season just past.

The power is furnished by the Corliss engine which drives our looms, our indicated horse-power being 50 without electric machines, and 73 horse-power with machines running. The shop was piped for gas with one seven-foot burner to every two looms, and additional burners in other parts of the shop, 167 in all. In stringing for electric lights we hung one incandescent lamp beside each gas burner, thus displacing only one gas jet by an electric lamp. The lamps were guaranteed for an average life of 600 hours. Since putting in the Weston machines we have run our 167 lamps every night, burning gas only during the stoppage of engine at midnight and morning, say a dozen burners one hour a day. We average the time of starting the two machines at April 15th, and reckon a full six months' average operation of the same—to October 15th—1,460 hours, the result of which is as follows:

Lamps broken in	April	9
" "	May	8
" "	June	7
" "	July	9
" "	August	10
" "	September	9
" "	to October 15th	8
Total		60

exclusive of twenty which were broken in starting the machines prior to April 3d, and seven imperfect lamps, which burned only an hour or two, and were returned for new ones. The time so far run is, in our judgment, too short to admit of an exact calculation of the actual life of the lamps. A breakage of ten per month as above, if continued indefinitely in the future, would indicate an average life of seventeen months—say, 4,000 hours. This we do not expect, but think we are safe in counting upon an average breakage of not over eighteen per month of 243 hours, giving a life of nine months, or 2,200 hours.

Assuming the life of the lamps as 2,200 hours, we have as the cost of lamps per year of 3,360 hours an equivalent of 255 lamps, at $1.50 each	$382 50
Attendance, one man, at $9 per week	468 00
Fifteen per cent. on cost of machines, shafting, belts, etc. ($4,328)	649 20
Oil, brushes and sundry supplies, estimated	130 00
Twenty-three horse-power, at $1\frac{75}{100}$ cents per 100 horse-power, per hour for 3,360 hours	966 00
	$2,595 70
Cost of gas, 167 seven-feet burners, 3,360 hours, 3,927,840 feet gas, at $2 per M	$7,855 68
In Providence we should be allowed a rebate on this quantity of gas, say 25 cents per thousand feet	
Cost of electric lighting $\frac{46}{100}$ of 1 cent per lamp per hour, equivalent to gas at 66 cents per thousand feet	

In the above figures we have charged to interest account an excessive amount, intended to cover depreciation and breakage. Up to this date we have had no breakage, and the machines are in better running order than when first put in. We have also charged to power the full proportion of the 23 horse-power used. We think it fair, however, to reckon against electric light only the expense of power in excess of what it was costing us before using the electric machines; inasmuch as we had our engine and boiler plant and the expense of engineers, supplies, interest, and the larger part of the fuel while using only 50 horse-power. As most manufacturers are in the same position, the actual cost of adding electric machines to an existing plant of machinery would be, as regards power, much less than the proportion of horse-power added

In our case we estimate the difference of cost per annum at not over	$500 00
Adding this to attendance, lamps and supplies as above	980 50
And 6 per cent. for interest on plant	259 68
We have	$1,740 18
which may be regarded as the actual cost per annum to us thus so far.	
To this should be added a depreciation account, say of 8 per cent., or	346 24
Or a total of	$2,086 42

which we believe to be a close estimate of the cost to us of 167 lamps, running or burning 3,360 hours per year, or ⅝ cents per lamp per hour, equivalent to gas at 53 cents per thousand feet.

The cost of several of the above items could be reduced largely by mills using larger engines and more electric machines. For instance, the cost of power—in our case, 1¼ cent. per horse-power per hour—should be brought to less than one cent, while one attendant at, say, $2 per night, could run six electric machines instead of two, as in our case. The cost of machines, lamps and supplies will probably be reduced by competition as well as by improvements in the manufacture of the same, and there will doubtless be an increase in the actual duration of incandescent lamps.

We think it fair to state that we have a short circuit and a favorable one, with the dynamos placed in the same room with the lamps, and an easy load on our engine. Our running nights are also calculated to reduce the cost of the electric light to us. Our shop, however, is, on the whole, not an easy one to light, owing to the fancy heads on our looms and the heavy framework overhead for Jacquard attachments. We were obliged, in consequence, to use a large number of lamps for the area lighted, and the test against a seven-foot gas jet was a severe one for the electric lamps. We have had for six months a perfectly satisfactory light, with little trouble from any source, and as machines in actual operation every night during this time we have no hesitation in saying that your Weston dynamos, with the Maxim lamps, have passed beyond the experimental stage, and seem to us an assured success.

We remain, very truly yours,

Grant Brothers.

Editor Electrical Review:

Dear Sir,—Will you kindly correct a statement in your report of the proceedings of the Inventor's Convention in your issue of Nov. 1st,

The Committee of Arrangements had asked Mr. Marble, late Commissioner of Patents, whether he would accept the presidency of the Protective Association if unanimously elected to that office, and the dispatch read was in answer to that inquiry. Mr. Marble was unanimously elected.

F. W. Warner,
Secretary American Patent Protective Association.

New York, Nov. 7th, '83.

Editor Electrical Review:

At a meeting of the stockholders of the Consolidated Electric Light Company, New York, held this day (November 7, 1883), the following gentlemen were elected trustees for the ensuing year:

Edwin S. Thayer.
H. R. Gordon.
Hon. Wm. Windom.
Hon. Preston B. Plumb.
Judge James Keith, of Virginia.
Albon Man.
Henry Dexter.
Jacob Hays.
John J. Anderson.
Horace Little.
Herbert L. Judd.
Henry I. Jenkins.
Amos Broadnax.

William Richardson,
Secretary.

Extract from "Engineering" of October 19, 1883.

THE OTTO GAS ENGINE.

"We learn that in the action of Otto *vs.* Ashbury, Sumner & Co., Otto *vs.* Ogden, and Otto *vs.* Biskerton & Co., all of which were brought by Mr. Otto to restrain infringement of his patent, No. 2081, 1876, the respective defendants have submitted to orders for a perpetual injunction in terms similar to those of the judgment given by Court of Appeal in favor of the same plaintiff in the action of Otto *vs.* Linford; and further, that in the similar action of Otto *vs.* Whittaker, judgment has also been obtained for an injunction."

This decision would seem to give the manufacturers of the Otto engine the field in Europe, as well as here, without opposition.

NEW PATENTS—ELECTRICAL—1883.

Index of Inventions for which Letters Patent of the United States were Granted in the Week ending November 6, 1883.

287,800 Electro-magnetic dynamometer; C. F. Brackett, Princeton, N. J.

287,812 Galvanic battery cell; Lucius E. Felton, Potsdam, N. Y.

287,830 Telegraph insulator; Charles C. Hinsdale, Cleveland, Ohio.

287,855 Electric igniting device for gas-engines; Lewis C. Parker, Yonkers, N. Y.

287,873 Automatic crank-switch for telephone call-boxes; Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place.

287,875 Lightning arrester; Charles S. Shephard, Raymond, N. H.

287,881 Tower for electric lights, &c.; Chas. D. F. Smith, Aurora, Ill.

287,896 Telephone receiver; Samuel H. Bartlett and Henry E. Waite, New York, N. Y., assignors to the Molecular Telephone Company, same place.

287,914 Telegraphic transmitter; Merritt H. Dement, Chicago, Ill.

287,957 Electrical apparatus for and method of controlling paper, &c.; John W. Osborne, Washington, D. C., assignor to William H. Forbes, Boston, Mass.

288,002 Means for insulating, carrying, and laying electric wires; Francis Wayland Brown, Rochester, N. Y.

288,017 Telephonic transmitter; Henry Clay, Philadelphia, Pa.

288,042 Dynamo-electric machine; Wm. B. F Elphinstone, Carberry Tower, Musselbergh, Scotland, and Chas. W. Vincent, Holloway, County of Middlesex, England.

288,051 Armature for dynamo-electric machines; J. Edwin Giles, Hazleton, Pa.

288,089 Station call for electric circuits; Thomas William Mather, New Haven, Conn.

288,107 District, police, or fire telegraph; Frederick Pearce, New York, N. Y.

288,157 Voltaic arc light; William Baxter, Jr., Jersey City, N. J.

288,175 Circuit and apparatus for electric clock systems; Jas. Hamblet, Brooklyn, N. Y.

288,183 Telephone support; Chas. H. Ohly, Sandusky, assignor to Adam J. Frederick, Oberlin, Ohio.

REISSUES.

10,401 Machine for making electric cables; John Farrell, Pittsburgh, Pa.

10,402 Machine for making electric cables; John Farrell, Pittsburgh, Pa.

10,403 Insulating compound for electrical conductors and apparatus for compounding the same; J. Burrows Hyde, New York, N. Y.

10,404 Apparatus for applying insulating material to electric wires; J. Burrows Hyde, New York, N. Y.

BUSINESS NOTICES.

For Sale—United States and Canadian rights in an arc lamp; inventor desires to sell his patents outright for a moderate sum. Address "Arc Lamp," P. O. Box 3329, New York City.

A mechanical and electrical engineer, graduate of the United States Naval Academy, desires an engagement; highest testimonials. Address G. S., 25 Bowdoin street, Boston, Mass.

For Sale.—One second hand 8 inch nickel plating machine, good as new, used but little. W. B. Wallis, Fitchburg, Mass.

At a meeting of the directors of the Electric, Manufacturing and Miscellaneous Stock Exchange, it was resolved to close the subscription books for the first limited allotment of seats at $250 on or before November 17, prior to the opening of the exchange.

Application blanks may be had of and subscriptions made through and payable to the order of

The Third National Bank, No. 20 Nassau Street;

The St. Nicholas Bank, of New York, No. 7 Wall Street;

The Chatham National Bank, No. 196 Broadway; or

Messrs. Hagen & Billing, bankers, No. 1 Wall Street.

All applications must be accompanied by check and name and address of applicant. (The right to reject reserved.) Subscriptions can also be made to and information obtained of the Secretary, Duncan Building, No. 11 Pine Street.

MUTUAL

DISTRICT MESSENGER COMPANY,

—) OF BOSTON. (—

Principal Office, Old State House, State Street, Boston, Mass.

J. M. PRENDERGAST, President,
D. J. HERN, Gen. Manager, W. H. SMITH, Sup't.

DEPARTMENT FOR THE

Addressing and Distribution of Circulars.

NOTICE TO ADVERTISERS AND OTHERS.

We have in our employ experienced persons to address, fold and envelope advertising matter for distribution by mail or by our messengers.

We distribute Circulars, Handbills, Notices, etc., PROPERLY, and at less rate than can be done by any other manner, considering the thoroughness of our work.

SPECIAL arrangements made for any respectable kind of service; well drilled and neatly uniformed messengers employed to do the same. Will furnish estimates for delivering circulars, etc., to any city or town in Massachusetts.

OUR RATES FOR DELIVERY IN BOSTON ARE AS FOLLOWS:

Handbills, delivered on the Street,		$1.00	per 1000
" " in the Stores,		1.50	"
Unaddressed Circulars, (in envelopes)		3.50	"
" " "	2,000 to 5,000,	$3.00	"
Addressed Circulars,		7.00	"
" "	2,000 to 10,000,	6.00	"
" "	10,000 to 25,000,	5.00	"
Pamphlets, (small), delivered on Street		4.50	"
" " "	in Houses	6.50	"
" (large), "	on Street	6.00	"
" " "	in Houses	8.00	"

Our price for addressing, folding, and mailing, (including envelopes and postage) is $20.00 per thousand for ordinary circulars of not more than 2 ounces. Special rates on lots above 10,000, and on books and other heavy advertising matter.

The Wright Patent Cable Clip.

This is the most economical and easily-applied device for suspending aerial cables. It is very light and strong, and will not rust. The clip is used extensively, and is highly recommended by the management of the Boston, Providence, Washington, and other telephone companies in this country and Canada. The gain in time of workmen in putting up cables will save more than the cost.

The Howard Safety Appliance (Patented.)

This device comprises a lightning arrester, cut out, and fusible wire, in a compact form, to be placed outside of the house or place of business of the subscriber; the electric current, by means of an arm extending inside of the building, being entirely cut off from the interior at the will of the subscriber, while fusible wires afford additional protection when the instrument is in circuit should an excessive charge, as from electric light currents, be accidentally thrown upon the telephone line. The advantages of this device are too obvious to need further comment. It is in successful use in Providence and other exchanges, and is in increasing demand wherever it has been introduced.

The Breckenridge Jack (Patented.)

This is a device for looping in the Central Office telephone without breaking circuit, or in any way interfering with the free conversation of subscribers who may be using the line. The central telephone office in Providence has used this device in preference to all others. Two years' experience has proved its perfect reliability and adaptation to any of the wants, in this respect, of a large telephone exchange. It is in use in some fifteen or twenty exchanges in the country, and is recommended by all who are familiar with it.

The Providence Switchboard (Patented.)

This is the new style of switchboard, invented by Mr. Breckenridge, of the Providence company, which is used exclusively in the Providence central office, where there are over eighteen hundred subscribers' lines in one room. It admits of expansion to accommodate at least three thousand subscribers' lines in one room. It is the most compact switchboard of its kind yet invented. It brings all the working parts within reach of the operator without stretching, and all the connecting wires and points being encased in rubber, has practically no leakage or induction. It has been found indispensable to quick and economical work in a large central office. It is the only switch which can be used advantageously for metallic circuits. The Worcester office has been equipped with this board, and switches for Springfield office are now being made. Every large exchange should examine this switchboard thoroughly before making a choice in this respect.

Rhode Island Telephone & Electric Co.,
PROVIDENCE, R. I.

— LATEST OUT. —

SMITH'S MANUAL OF TELEGRAPHY

SEVENTEENTH EDITION.

New and Revised. Just Issued by

L. G. TILLOTSON & CO.

PUBLISHERS AND SOLE PROPRIETORS.

Besides full instructions in the Art of Telegraphy, this Book Contains One Hundred and Seventy-five Pages of all of the latest and best Telegraph and Electrical Instruments, Batteries and Supplies in Use.

Five Pages of Registers.
Six Pages of Relays, twenty different styles.
Four Pages of Sounders, twelve different styles.
Six Pages of Keys, sixteen different styles.
Eight Pages of Cut-outs, Switches, Lightning Arresters and Galvanometers.
Four Pages of Learners' Instruments, Binding - Posts and Connectors.
Nineteen Pages of Electric Call Bells, Burglar Alarm and House and Hotel Annunciators, Material, Diagrams, and Descriptions.
Eighteen Pages of Batteries, Fifty Different Styles.
Four Pages of Insulators, Nineteen Different Styles.
Twenty-three Pages of Builders' and Repairers' Tools.
Ten Pages of Insulated Wires and Cables, two hundred different styles.
Five Pages of Latest Books on Electrical Science.
One Hundred and Fifty Different Books.
Fourteen Pages of Office Supplies.
Six Pages of Electro-Medical Apparatus.
Four Pages Dynamo and Magneto Electric Machines.
Six Pages of Experimental Apparatus
Two Pages of Electrical Toys.
Four Pages of Electric Gas Lighting Apparatus.
Seven Pages Electro Plating Apparatus, for Gold, Silver and Nickel.
Induction Coils, all sizes.
Leyden Jars and Condensers.
Geissler Vacuum Tubes.
Geissler Tube Rotators.
Electric Lamps. Galvanic Lamps.
Snapper Sounders.
Electric Blasting Apparatus.
Office Clocks, eleven different styles.
Telephone Bells.
Telephone Batteries.
Telephone Switches.
Telephone Cords.
And other Telephone Supplies.
Office and Main Line Staples.
Steel, Brass and Plated Message Hooks.
Carbon Plates and Electric Light Carbons. Chemicals and Metals.
Battery Directions.
Acid Pumps. Line Material.
Velocipede Hand Cars.
Soldering Apparatus.
All Sizes of Platinum Wire.
Electro and Permanent Magnets.
Office Wire Cleats, all sizes.
Rubber Window Tubes, all lengths.
Automatic Signal Boxes.
Bell Strikers.
Fire Alarm Boxes.
All sizes of the Best Brands of English and American Galvanized Iron and Steel Line Wire.

L. G. TILLOTSON & CO.

The Oldest & Largest Railway & Telegraph Supply House in America.

Manufacturers, Importers and Dealers in every Variety of Electric Apparatus, 5 & 7 Dey St., N.Y.

THE THOMSON-HOUSTON ELECTRIC CO.

FURNISHES THE

ONLY PERFECT, AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.

In all desirable qualities of ELECTRIC ARC LIGHTS the THOMSON-HOUSTON SYSTEM has no equal. The lights are *superior in color and steadiness*, and the entire apparatus is more *economical, efficient* and *safe*, more *easily managed*, and *less liable to derangement* than any other.

Principal Office, 131 Devonshire St., Boston, Mass.

H. A. PEVEAR, President. S. A. BARTON, Treas. and Manager. E. THOMSON, Electrician.
C. A. COFFIN, Vice-President. J. J. SKINNER, Secretary. E. J. HOUSTON, Consult'g Electrician.

DIRECTORS:

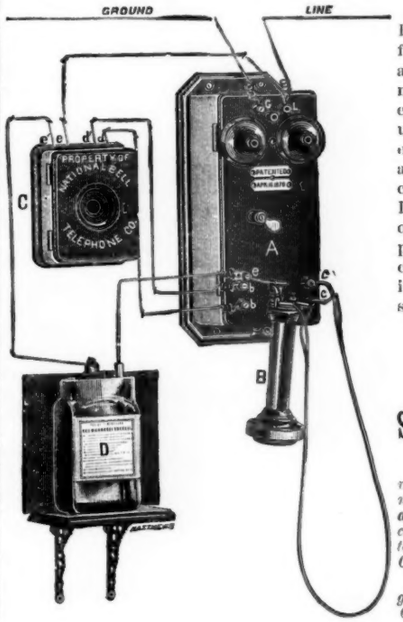
H. A. PEVEAR, B. F. SPINNEY, S. A. BARTON,
C. A. COFFIN, J. N. SMITH, E. THOMSON

New Illustrated Pamphlet will be sent on application.

THE

American Bell Telephone Co.

WM. H. FORBES, *President.* THEO. N. VAIL, *Gen'l Manager.* WM. R. DRIVER, *Treasurer.*



This Company owns the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controls, except for certain limited territory, under an arrangement with the Western Union Telegraph Co., the Gold and Stock Telegraph Co., the American Speaking Telephone Co., and the Harmonic Telegraph Co., the Patents owned by those Companies, and is prepared to furnish telephones to the citizens of the United States through its local Licensees, on the following systems:

EXCHANGE, PRIVATE LINE, & SPEAKING TUBE LINES

Those desiring instruments on Private or Speaking Tube Lines, or connections on Exchanges, will please apply to the nearest Licensed Exchange, when their case will be brought to the attention of the proper local Company.

Any further information will be gladly furnished on application to the Company at its office,

No. 95 MILK STREET, BOSTON, MASS.

All persons using telephones not licensed by this Company, are hereby respectfully notified, that they are liable to prosecution, and for damages for infringement, and will be prosecuted according to the full extent of the law.

PAINE & LADD,

HALBERT E. PAINE, Late Commissioner of Patents. STORY B. LADD.

Attorneys in Patent Causes
And Solicitors,
WASHINGTON, D. C.

LYNCH & BANTA,

98 Washington St., Chicago.

Telephone Stocks

Bought and Sold on Commission.

MEMBERSHIPS.

At a meeting of the Directors of the

Electric, Manufacturing & Miscellaneous

STOCK EXCHANGE,

It was resolved to close the subscription books for the first limited allotment of seats at $250, on or before Nov. 17th, prior to opening of the Exchange.

Application blanks may be had of and subscriptions made through and payable to the order of

The Third National Bank, No. 20 Nassau Street.
The St. Nicholas Bank, of N. Y., No. 7 Wall St.
The Chatham National Bank, No. 196 Broadway, or
Messrs. Hagen & Billings, bankers, No. 1 Wall St

All applications must be accompanied by check and name and address of applicant. (The right to reject reserved.) Subscriptions can also be made to, and information obtained of, the Secretary, Duncan Building, No. 11 Pine Street.

JUST PUBLISHED.

Fully Illustrated, Price, $3.00,

PHILIP REIS:

Inventor of the Telephone.

A Biographical Sketch, with documentary testimony, translations of the original papers of the inventor and contemporary publications. By SILVANUS P. THOMPSON.

Catalogue of Electrical Books free on application.

E. & F. N. SPON,
35 MURRAY STREET, NEW YORK.

JUST OUT.

ELECTRICITY

In Theory and Practice,

Or the Elements of Electrical Engineering

BY

Lieut. BRADLEY A. FISKE, U.S.N.

PRICE $2.50.

8vo. Cloth, 180 Illustrations.

Copies sent postpaid by mail, on receipt of price.

D. VAN NOSTRAND, Publisher.

23 Murray and 27 Warren Streets, NEW YORK.

Complete Catalogue of Electrical Books will be sent to any address on application.

Binders for the Electrical Review.

We are now prepared to furnish for the convenience of subscribers to the REVIEW one of the latest improved self-binders. The binders are of the exact size of the paper, and each issue as received can be filed in it without trouble. When the volume is complete at the end of the year, it can be permanently fastened in a moment, making in appearance a volume almost as durable as one especially bound. The binder will be sent, postage prepaid, to any part of the United States on receipt of $1.00. Address, Delano & Company, P. O. Box, 3329, 23 Park Row, New York.

HAINES BROS.,

Promoters and Brokers

55 BROADWAY, N. Y.

Electrical Stocks a Specialty.

H. M. RAYNOR,

No. 25 Bond Street,
New York.

ESTABLISHED 1859.

PLATINUM IN All Forms FOR ALL PURPOSES,

Wholesale and Retail

CHARLES E. FOSTER.
FRANK L. FREEMAN, { Late Examiner in charge of Class Electricity Patent Office.

FOSTER & FREEMAN,
SOLICITORS OF PATENTS
AND
COUNSELORS IN PATENT CAUSES,
Mechanical and Electrical Experts
WASHINGTON, D. C.

OFFICES: 931 F STREET.

VIADUCT MANUFACTURING COMPANY
OF BALTIMORE CITY.

Works: Relay Station, B. & O. R. R. Office: Chamber of Commerce, Room 29 and 31.

This Company, in connection with its present affairs, will continue the business of the late firm of DAVIS & WATTS, to which it has succeeded; the latter firm having dissolved, and Mr. Augustus G. Davis, its senior member, having assumed its entire assets and liabilities.

Mr. Davis has transferred to this Company (of which he is President) all interests of whatever nature heretofore pertaining to Davis & Watts, and will henceforth give his personal supervision to the manufacture of

ELECTRICAL GOODS OF EVERY DESCRIPTION.

Having increased facilities and ample capital, we will carry a large stock of

TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND AMERICAN DISTRICT SUPPLIES

of all kinds. Our Works are on the Patapsco River, at the Relay Station, B. & O. R. R., with an abundance of water-power. We carry continually a large stock of CROSS-ARMS, PINS, BRACKETS, INSULATORS and WIRE (both Line, Office and Electric Light) and our prices will be found most reasonable.

We solicit a continuation of the favors heretofore extended by customers to the late firm of Davis & Watts, in the assurance that we can, and will make it to their advantage. We have in preparation a new illustrated catalogue, which, when ready, we shall be pleased to furnish.

VIADUCT MANUFACTURING COMPANY. A. G. DAVIS, President.

STANDARD ELECTRICAL WORKS,
MANUFACTURERS OF
TELEGRAPH & TELEPHONE INSTRUMENTS

LARGE STOCK ON HAND OF

LINE WIRE (all sizes), ELECTRIC LIGHT WIRE (all sizes), CARBONS, &c., &c., OFFICE WIRE AND SUPPLIES, LECLANCHÉ AND OTHER BATTERIES.

Special facilities for manufacturing PINS & BRACKETS, very low prices for car-load lots.

MANUFACTURING LICENSEES OF

AMERICAN BELL TELEPHONE COMPANY.

Send for illustrated Catalogue and special prices.

STANDARD ELECTRICAL WORKS,
CINCINNATI, OHIO, U. S. A.

THE KERNER STYLOGRAPHIC PEN.

$1.00 $1.00

Made of the best materials throughout, and the only Pen in the World with the Flexible Air Tube which insures Perfect Satisfaction.

FOR SALE BY ALL DEALERS.

THE KERNER STYLOGRAPHIC PEN CO., 25 BOND STREET, NEW YORK.

ИЛЛЮСТРИРОВАННЫЕ КАТАЛОГИ
EXECUTE
IN FIRST CLASS STYLE AND WITH DESPATCH
O.W. MADDAUS
DESIGNER AND ENGRAVER ON WOOD
23 PARK ROW NEW YORK

NEW ENGLAND BUTT CO.
PROVIDENCE, R. I.

MANUFACTURERS OF

BRAIDING MACHINERY

FOR COVERING

Telegraph, Telephone and Electric Light Wire;

ALSO

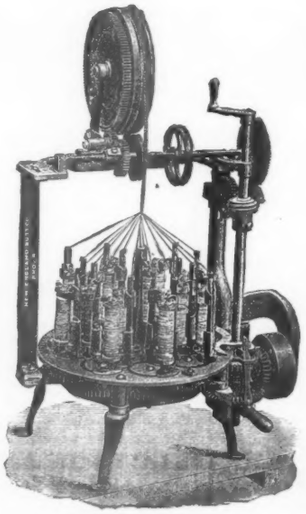
SINGLE & DOUBLE WINDERS

AND

BRAIDERS

Of every description,

For Silk, Worsted and Cotton Braid.



FINE CASTINGS A SPECIALTY

Rhode Island Braiding Machine Co.

89 ABORN ST., PROVIDENCE, R. I.

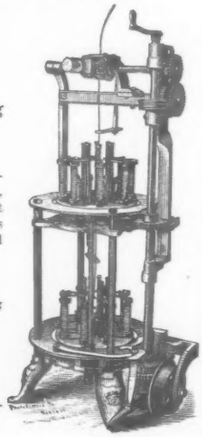
General Machinists.

Our Specialty being in

Braiding & Winding Machinery,

Braiders and Winders for covering all kinds of Telegraph, Telephone, and Electric Light Wire, and for making all sizes of Worsted, Silk, Cotton and Mohair Braid.

Packing Braiders, Coir Matting Braiders, Quillers, Hankers, Measuring Machines, &c., &c.



Also a full stock of Spools, Bobbins, and Braiders' Supplies.

The Coe Brass Mfg. Co.

MANUFACTURERS OF

BRASS,

Copper & German Silver,

IN EVERY VARIETY OF

SHEETS, ROLLS, PLATES, WIRE, RODS & BLANKS OR SHELLS,

Pure Lake Superior Copper Wire

A SPECIALTY,

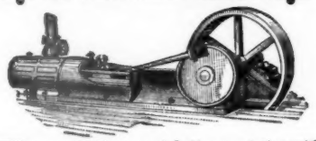
BATTERY ZINCS.

TORRINGTON, Litchfield Co.,

CONN., U. S. A.

THE PAYNE

Single and Double Valve Automatic Engine.



Will guarantee 20 per cent. better regulation with our *single slide valve automatic engine* than can be attained by any other engine in the market. For sale by E. P. Hampon & Co., 36 Cortlandt St., N.Y., Hill, Clark & Co., Boston, Mass. Write for Circular No. 36. B.W. Payne & Sons, Box 1450, Corning, N.Y.

LECLANCHÉ.

Prism Battery. Complete Size of Jar, 6x4½ inches.

THE GREAT

Telephone Battery.

THE STANDARD OPEN CIRCUIT BATTERY OF THE WORLD.

Over 500,000 cells now in use in the United States and 1,000,000 in Europe.

ADOPTED BY ALL THE

TELEPHONE COMPANIES.

THE SIMPLEST, CLEANEST, MOST DURABLE, MOST ECONOMICAL.

Beware of Infringements and Cheap Imitations.

LECLANCHÉ BATTERY CO.

149 W. 18th St., N. Y., or

L. G. TILLOTSON & CO., 5 & 7 Dey St., N. Y.

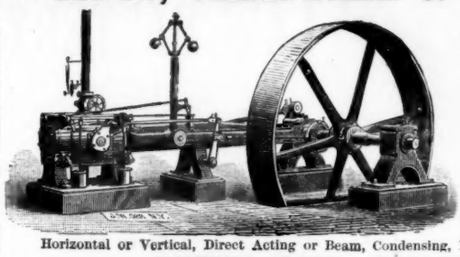
SPENCERIAN INK

Extra Black, Blue Black, and Copying, all of superior quality, claiming Special excellence in the essentials of Fluidity, Color and Durability. Circulars free.

Ivison, Blakeman, Taylor & Co., N. Y.

WATTS, CAMPBELL & CO., NEWARK, N. J.

MANUFACTURERS OF



Improved Corliss

STEAM ENGINES

IN FULL VARIETY.

Sizes varying from 30 to 2000 H P.

Preferred above all others by the United States and Brush Electric Lighting Co.'s for regularity of speed and economy.

Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound

SEND FOR CIRCULAR.

Holmes, Booth and Haydens,

MANUFACTURERS OF

FIREPROOF ELECTRIC LIGHT WIRE,

From Pure Lake Superior Copper.—Conductivity Guaranteed.

PATENT

"K. K." Insulated Copper and Iron Wire,

For Telephone and Telegraph Use.

49 CHAMBERS STREET, NEW YORK;

18 FEDERAL STREET, BOSTON

WORKS AT WATERBURY, CONN.

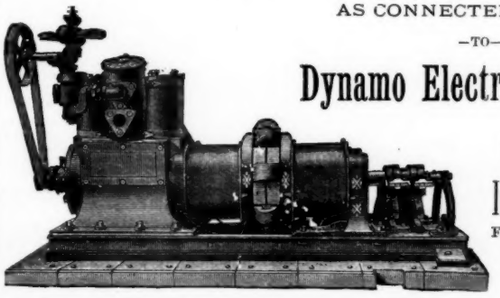
GEORGE WESTINGHOUSE, Jr., President. RALPH BAGALE., Secretary and Treasurer. H. H. WESTINGHOUSE Superintendent.

THE WESTINGHOUSE ENGINE

AS CONNECTED DIRECT

—TO—

Dynamo Electric Machines



OF ANY MAKE For Electric Lighting.

ALSO

Independent Engines

For driving by Belt *Counter-Shafting.*

Send for Illustrated Circular.

THE WESTINGHOUSE MACHINE COMPANY,

Works at Pittsburgh, Pa. 92 & 94 Liberty Street, New York.

Western Office, 14 South Canal St., Chicago, Ill.

VICTOR BISHOP & CO.,

IMPORTERS OF DIAMONDS,

PLATINUM

For all Manufacturing, Chemical, Electrical, Dental, and Laboratory purposes.

Victor Bishop & Co.,

ESTABLISHED 1837 No. 33 MAIDEN LANE, NEW YORK.

Electric Light Apparatus

—AND—

ELECTRICAL INSTRUMENTS

Of Every Description

BUILT BY DAY OR CONTRACT.

Have had five years' experience building Electric Light Apparatus. Facilities for making complete apparatus for 50 Arc Lights a day. Everything made on the **INTERCHANGEABLE** system. Twenty years' experience designing and building Special and Labor-Saving Machinery. Estimates given. Correspondence solicited.

JAMES BRADY,

(SUC'R TO BRADY MFG. CO.)

257 and 259 WATER STREET,

BROOKLYN, N. Y.

MAGNET STEEL

AND ALL KINDS OF

CHROME CAST STEEL.

STEEL for MAGNETS

A SPECIALTY,

And warranted superior to all other brands.

CHROME STEEL WORKS,

Brooklyn, E. D., N. Y.

S. H. KOHN, *Proprietor.* C. P. HAUCHIAN, *Superintendent.*

ESTABLISHED 1864.

WILLIAM A. HARRIS

MANUFACTURER OF

HARRIS-CORLISS

STEAM ENGINES

With Harris' Patented Improvements

ALSO

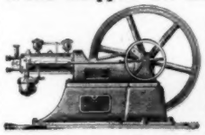
Light & Heavy Iron Castings,

PROVIDENCE, R. I.

"OTTO" GAS ENGINE

OVER 10,000 IN USE.

Started Instantly by a Match. When Stopped all Expense Ceases.



Works without boiler, steam, coal, ashes or attendance. Successfully adapted instead of steam power in all industries and offers special advantages for running electrical machinery for Telegraph and Telephone as well as Lighting purposes.

Built in Sizes of 1, 2, 4, 7, 10, 15 & 25 Ind. H. P.

SCHLEICHER, SCHUMM & CO.

N. E. cor. 33d & Walnut, Phila.

Branch Office: 214 Randolph Street, Chicago.

JOHN H. MUEGGE,

IMPORTER OF

PLATINUM.

Manufacturer of all kinds of Chemical Apparatus Crucibles, Vessels, &c., Wire for Electrical Purposes Plate and Wire for Dentists. Scraps Purchased.

No. 91 Liberty St., New York.

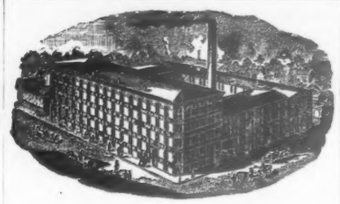
ALFRED F. MOORE,
MANUFACTURER OF
Insulated Wire,
—FOR—
Telephone, Telegraph and Electric Light,
OFFICE, LINE,
—AND—
ANNUNCIATOR WIRE,
Magnet Wire and Flexible Cordage,
200 & 202 N. THIRD ST.,
PHILADELPHIA, PA.

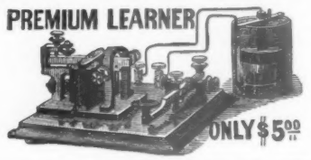
A. L. BOCART,
ELECTRICIAN,
No. 22 UNION SQUARE, N. Y., 4th Ave. Side,
Patentee and Manufacturer of every variety of
Electric Gas-Lighting APPARATUS
For Theatres, Churches, Public and Private Buildings.
The trade furnished with the most complete assortment of Electric Lighting Burners, including Pendant, Ratchet, Argand, Billiard Table, Candle, Automatic, and Vibrators, also Clough, Maxim, Firrell Ring and Arm Burners, for use with Machine Gas. Batteries, Primary Coils, Three Styles of Automatic Cut-offs, and All Supplies Necessary in Fitting Up Buildings. All Apparatus Patented.
Also, Burglar Alarms, Annunciators, Call Bells, &c.

PHOSPHOR-BRONZE
TELEPHONE WIRE.

"Phosphor-Bronze."
Combines High Electrical Conductivity and Resistance to Corrosion with Lightness and Tenacity.
Standard Sizes, 16, 17 and 18, Stubs' Gauge.
ADDRESS:
THE PHOSPHOR-BRONZE SMELTING CO.,
(LIMITED.)
512 ARCH ST., PHILADELPHIA, PA.
Owners of the United States Phosphor-Bronze Patents.
Sole Manufacturers of Phosphor-Bronze in the United States.

PLACE IT IN YOUR SAFE.
Invest $8 for $10,000 Accident Policy with $50 Weekly Indemnity in the
320 & 322 BROADWAY, **UNITED STATES** NEW YORK.
Mutual Accident Association
and place it in your safe. Twenty-five dollars a year will carry this insurance, and should misfortune overtake you in the way of fatal or disabling injury, there will never be cause to regret your forethought and prudence. European permits without extra charge.


American Electrical Works
MANUFACTURERS OF
Patent Finished Insulated
Electric Wires,
TELEPHONE AND ELECTRIC CORDAGE,
ELECTRIC LIGHT WIRE
MAGNET WIRE,
PATENT RUBBER COVERED WIRE, BURGLAR ALARM AND ANNUNCIATOR WIRE, LEAD-ENCASED WIRE, ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES ETC., ETC.
OFFICE AND FACTORY:
No. 67 STEWART STREET,
PROVIDENCE, R. I.
EUGENE F. PHILLIPS, President.
W. H. SAWYER, Sec. and Electrician.

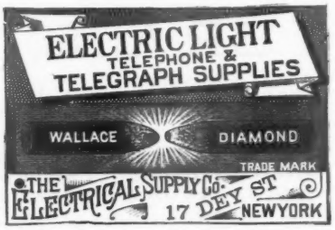
PARTRICK & CARTER,
Philadelphia, Pa.,
MANUFACTURERS OF
Telephone, Telegraph
And Electrical Instruments and Supplies.
Among our SPECIALTIES are the CELEBRATED


Not the Cheapest, but GUARANTEED THE BEST.
COMPLETE OUTFIT ONLY $5.00.
The Fitch Chlorine Battery, patented Sept 16, 1879, acknowledged the **Best** Battery in use for Telephones, Annunciators, Call Bells, etc. Price, $1.50 per cell. Liberal discount to the trade.
The Acme Steel Lever Key, best and most perfect Key ever placed before the telegraphic profession; endorsed by hundreds of the most expert telegraphers in the country. Price by mail, $3.00.
The **Original Giant Sounder,** price $4.00 by mail. Send for our catalogues and price lists. Correspondence solicited.
PARTRICK & CARTER,
Telephone, Telegraph & Electrical Instruments and Supplies of every description,
114 SOUTH 2d ST., PHILADELPHIA, PA.

THE
LAW BATTERY.

The BEST Open Circuit Battery in the World and the CHEAPEST.
Combines all the advantages of the best of the others, without any of their disadvantages.
Thousands sold monthly. Send for circular. Manufactured and sold by the
LAW TELEGRAPH CO.,
140 Fulton St., New York.

Spiral Telephone and Telegraph Wire,
For Long and Short Distance Telephoning. Unlimited Distance for both Telephone and Telegraph Service.
Underground, Aerial and Submarine.
The agitation of each separate molecule comprising the central portion of the Spiral Wire is in a **direct** line with the length of the wire, the electrical current having an **unretarded straight** circulation through the central core from end to end, **protected** by four or more spirally arranged surfaces on the exterior of said wire, which convey continuous spiral currents, constantly throwing aside the adjacent inductive currents of other parallel wires, and also all atmospheric influences likely to retard the reproduction of articulation; hence **INSTANTANEOUS** reproduction of articulation from end to end of the spirally grooved wire over unlimited distances.
For telegraph use the Spiral Wire must be acknowledged as the only **perfect conductor,** breaking the circuit instantaneously and admitting of greatly increased rapidity of telegraphic communication.
The Spiral Wire is its own insulator. Its agitation is **instantaneous throughout.** The longer the Spiral Wire the less is it affected by any outside inductive influences, and absolutely uninterrupted pathway is ensured throughout the core.
The weight of unlimited distance Telephone and Telegraph Wire is but 110 lbs. per mile.
Orders will meet prompt attention.
The patents for this electrical conductor were granted only after long, practical tests at Washington, and its superiority acknowledged by the best electrical authority, who had heretofore pronounced it a fallacy.
American Spiral Telephone Wire Co.,
43 Milk Street, Boston, Mass., U. S.



A. C. NORTHROP,
Waterbury, Conn.
Iron and Brass Machine Screws
ZINC IN SHEETS AND PLATE FOR ELECTRICAL PURPOSES.
Parts for Telegraph and Telephone Instruments,
MANUFACTURED FROM
Iron, Brass, Steel, or Zinc.
Opportunity to Estimate on patented articles from Sheet Metal, Rod or Brass Castings, respectfully solicited.

H. McGONEGAL. S. D. LAKE.
McGONEGAL & LAKE,
Electricians,
Telegraph Engineers and Contractors,
Organized, Construct and Equip District Telegraph Companies, build Railroad or Private Telegraph Lines.
TEMPLE COURT, 5 BEEKMAN ST.,
Room 25, New York
We are prepared to furnish—AT BOTTOM FIGURES—supplies to District Telegraph Companies.
Competent men as Superintendents, Managers, Clerks and Linemen for District Telegraph and Telephone Companies. All kinds of Wire, Cables, Registers—SINGLE AND DOUBLE PEN—Relays, Bells and Switches, Signal Boxes—FROM ONE TO ELEVEN CALLS—Messengers' Uniforms, Caps, etc. Record of Call Books, Subscribers' Ledgers, Messengers' Tickets, Instrument Backboards, Cleats, Insulators, Batteries and Telegraph Supplies generally.
RUBBER TAPE, superior to all others, for DISTRICT TELEGRAPH, TELEPHONE, BURGLAR ALARMS AND ELECTRIC LIGHT purposes.
Execute commissions with cair and fidelity. Telegraph and Telephone stocks and territory bought and sold. Correspondence solicited.
ELECTRIC LIGHT AT BOTTOM FIGURES.
Two Telephone Companies earning large dividends and susceptible of further development, for sale.

The Bergmann & Haid Battery.
THE GREATEST OPEN CIRCUIT BATTERY IN THE WORLD.

HEIGHT, 6¼ INCHES.
DIAMETER, 3¼ INCHES.
BERGMANN & CO. have now succeeded in supplying what has been till now the GREAT DESIDERATUM in Telephone and all open circuit work.
THIS BATTERY is not only the SIMPLEST, CLEANEST, most ECONOMICAL and most DURABLE of all, but it overcomes all the existing defects of the LeClanché and other forms hitherto employed. It is small, neat, compact and very portable. Hermetically sealed and guaranteed to form no gases. On this account it requires hardly any attention. It will last more than twice as long as any other. It is cheaper than any other.
Price, $1.20, Complete.
Samples sent to Dealers and Telephone Exchanges on application.
Send for Circular. Liberal Discounts to Dealers.
Bergmann & Co., Electrical Works, 292 to 298 Ave. B, cor. 17th St., New York.

THE
TRENTON IRON CO.
MANUFACTURERS OF
GALVANIZED IRON WIRE
OF VARIOUS GRADES FOR
Telegraph and Telephone Lines.

WORKS AND OFFICE AT
TRENTON, NEW JERSEY
NEW YORK OFFICE:
Cooper, Hewitt & Co., 17 Burling Slip.
PHILADELPHIA OFFICE:
21 NORTH FOURTH STREET.

THE ANSONIA
BRASS & COPPER. CO.,

MANUFACTURERS OF
Pure Electric Copper Wire,
For Magnets, Telephones, Electric Lights, etc.
WITH H. SPLITDORF'S PATENTED LIQUID INSULATION COVERED WITH COTTON OR SILK.
LINE WIRE.
Fire Proof House and Office Wire
For Indoor use in Electric Lighting.
Wrought Metal Gongs for Annunciators, Telephones, &c.
ZINC RODS, BATTERY COPPER &c.
Nos. 19 and 21 Cliff St., New York.

WESTERN
Electric Company,
CHICAGO, INDIANAPOLIS, NEW YORK,
MANUFACTURERS OF
TELEGRAPH INSTRUMENTS
AND SUPPLIES.

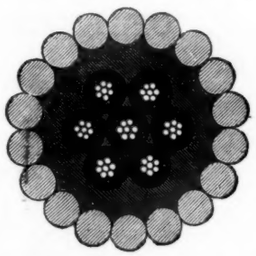
Insulated Copper Wires, Electric Bells and Annunciators, Burglar Alarms, the Electro-Mercurial Fire Alarm, Electro-Medical Apparatus, Electric Gas Lighting Apparatus, Edison's Electric Pen and Duplicating Press, the Gamewell Fire Alarm Telegraph Apparatus, Bi-Polar and Carbon Telephones, Telephone Exchange Apparatus, Underground Cables.

ANSON STAGER, President. ENOS M. BARTON, Vice-President.

CATALOGUES
SENT BY MAIL ON RECEIPT OF PRICE IN STAMPS OR CURRENCY.

	Pages.	Price.
I—Complete Set of Catalogues.	236	20c.
II—Telegraph Instruments and Supplies	64	6c.
IV—Insulated Wire (included in II.)		
V—Electric Bells, Annunciators, Electro-Mercurial Fire Alarm	32	3c.
VI—Electro-Medical Apparatus.	32	
VII—Manual of Telegraphy and Catalogue of Private Line Instruments	32	free.
VIII—Condensed Price List	20	free.
X—Electric Bells, etc., descriptive	12	3c.
XI—Magnets for Mills	20	3c.
Sir William Thomson's Nautical Instruments	24	5c.

THE BISHOP
Gutta-Percha Works.
(SAMUEL BOARDMAN, Agent.)



Original and only Manufacturers in the United States.

GUTTA-PERCHA INSULATED
Submarine Telegraph Cables,
50 Regular Sizes.
One to Ten Conductors.
Subterranean Telegraph Cables,
Hempen-Armored Covered.
Aerial Telegraph Cables,
Lead or Hempen Covered.
ANTI-INDUCTION
Telephone (Lead-Covered) Cables,
as used by the Metropolitan Telephone and Telegraph Company.
Torpedo Cables,
Recommended by the European and South American Governments.
Lead-Covered Cables,
For Canal and Streamlet Crossings.
GUTTA-PERCHA
Office Wire, Fuse, Leading and Connecting Wire,
For Subaqueous Mining and all other Electrical purposes.
Mark's Compound Insulated Wire,
For Office, Outdoor, Underground and Battery Use.
G. P. Office Wire,
Cotton-Covered.
ALSO HAVE ALWAYS ON HAND:
Wires of Every Variety of Insulation,
Magnet Wire, Telephone Flexible Cords, Flexible Elevator Cables, Electric Cordage.
Burglar-Alarm and Annunciator Wire,
Electric Light Wire, Cordage and Cables, Lead-Covered Wire, and Every Description of
Pure Gutta-Percha Goods,
Gutta-Percha Sheet, for Cable Splices: G. P. Chemical Vessels for Acids, etc.

Agents for Reception of Orders and Sale of Goods.
L. G. TILLOTSON & CO., 7 Dey St., New York.
WILLIAM HEATON, 503 Chestnut St., Phila.

THIRTY-THREE YEARS' EXPERIENCE HAS TAUGHT US THAT NEITHER THE ELECTRICAL NOR MECHANICAL QUALITIES OF EITHER GUTTA-PERCHA OR COPPER DETERIORATE BY LONG WORKING OR SUBMERSION, CONSEQUENTLY THE BEST FORM OF A SUBMARINE TELEGRAPH CABLE WILL BE THAT IN WHICH THESE CONDITIONS WERE FULFILLED.—*Extract from Report on Cables, by Willoughby Smith.*

MANUFACTURED BY
The Bishop Gutta-Percha Works.
Address all communications to
W. W. MARKS, Superintendent,
420, 422, 424 & 426 East 25th St., New York.
OFFICE AT THE WORKS.

S. W. FRENCH, President. W. C. DEWEY, Treasurer. FRANK F. BULLARD, Gen'l Manager.
PALMER WIRE COMPANY
PALMER, MASSACHUSETTS.

GALVANIZED
Telegraph & Telephone Wire
In Long Lengths, by our Continuous Process, and Pronounced by all Users as Unsurpassed in
QUALITY OF MATERIAL, FINISH AND CONDUCTIVITY.
Testimonials of same furnished if required. Line Men have less trouble with our Wire than with any other make. Put up in Half Mile Lengths.
Approximate diameter of Wire drawn by PALMER WIRE GAUGE, in thousandths parts of an inch.

No. 4—.225	*No. 7—.177*	*No. 10—.135*	*No. 13—.092*	*No. 16—.063*
No. 5—.207	*No. 8—.162*	*No. 11—.120*	*No. 14—.080*	*No. 17—.054*
No. 6—.192	*No. 9—.148*	*No. 12—.105*	*No. 15—.072*	*No. 18—.047*

Estimates on complete equipment of Private Lines furnished on application. Correspondence solicited.
New York Office, 20 Cliff Street.

LYNCH & BANTA,
98 WASHINGTON ST., CHICAGO,
—DEALERS IN—
TELEGRAPH
AND
TELEPHONE POLES.

BUTLER'S SAFES
FIRE & BURGLAR PROOF.
291 BROADWAY,
NEW YORK.

THE UNITED STATES
ELECTRIC LIGHTING CO.

THE WESTON ARC LIGHT
—AND—
THE MAXIM INCANDESCENT LIGHT
ARE SUPERIOR TO ALL OTHERS IN
EFFICIENCY, ECONOMY, RELIABILITY, SAFETY
—AND—
CONVENIENCE.

Perfect Automatic Regulation IN BOTH SYSTEMS.

Electric Motors, Electroplating Machines, Carbons, &c.

Office—59 & 61 LIBERTY STREET, NEW YORK.

GEO. W. HEBARD, President. LEONARD E. CURTIS, Secretary. PH. FERD. KOBBÉ, Treasurer.
TRUSTEES.
MARCELLUS HARTLEY, ANSON PHELPS STOKES, CHAS. R. FLINT, LOUIS FITZGERALD, } Vice-Presidents.
HENRY B. HYDE, JOHN A. STEWART, ROBERT B. MINTURN, GEO. W. HEBARD.
WALTER T. HATCH, HENRY DAY, THOS. H HUBBARD, LEONARD E. CURTIS.

SEND FOR ILLUSTRATED CATALOGUE.

WESTERN ELECTRIC COMPANY,

CHICAGO—INDIANAPOLIS—NEW YORK.

Telegraph and Telephone Apparatus and Supplies.

The Best of everything at Bottom Prices.

A. G. DAY,

Manufacturer of

Kerite Insulated

Telegraph and Telephone

Wire and Cables.

OFFICE, 120 BROADWAY, NEW YORK.

FACTORY, SEYMOUR, CONN.

ANTI-INDUCTION KERITE

Telephone Cables.

Some of them Two Miles in Length, are in use in several cities, and are found to WORK PERFECTLY for that distance.

Eminent Electricians and Practical Telegraphists

Commend and recognize the Kerite Insulation as superior to all others. At the CENTENNIAL EXHIBITION at Philadelphia, SIR WILLIAM THOMSON, the eminent Electrician and scientist, awarded to the

Kerite Insulated Wire and Cables

A DIPLOMA

For "Excellence of the Insulation and Durability of the Insulator."

GENERAL AGENT:

CLARK B. HOTCHKISS

120 BROADWAY, NEW YORK.

CHARLES WILLIAMS, JR.

(Established in 1856.)

Nos. 109-115 Court Street,

BOSTON, MASS.

AUTHORIZED MANUFACTURER OF

THE AMERICAN

BELL TELEPHONE CO.

Magneto, Crank and Push Button

CALL BELLS,

ELECTRIC BELLS,

DISTRICT BELLS

AND

Switches for Exchanges, Annunciators, &c.

—

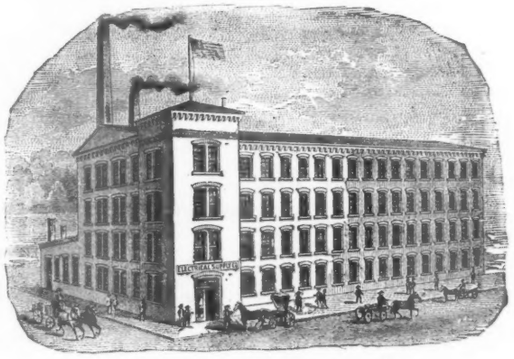
Telegraph and Electrical Instruments, Batteries, Wire, Insulators, and Telephone Supplies of every description.

THE ELECTRICAL SUPPLY CO.

MANUFACTURERS OF

Insulated Wire

OF EVERY DESCRIPTION.



(Factory of the Electrical Supply Co. at Ansonia, Ct.)

ELECTRIC LIGHT, TELEPHONE, AND TELEGRAPH SUPPLIES.

Warehouse: 17 DEY ST., NEW YORK.

FOR **ELECTRIC LIGHTING** Unequalled.

ARMINGTON & SIMS ENGINE COMPANY

TRADE MARK

PROVIDENCE, R.I. U-S-A

FOR **GENERAL USE** Unexcelled.

ARC LIGHTS.

We desire to call attention to the **BRUSH MACHINES** we are now manufacturing, intended to give lights of about two-thirds of the power of our usual size of arc lights. They are fully equal to the ordinary size lights of other systems, and except in the amount of light, are the same in every respect as our other lights.

Number of Machine.	Number of Arc Lights.	Nominal Candle Power.	Horse Power Required.
5	10	1,200	6
6	20	1,200	11
7	30	1,200	15
8	64	1,200	35

Prices of machines and lamps same as the regular list. Our agents will give you estimates.

We shall commence this month the shipment of **BRUSH STORAGE BATTERIES**, to fill the large orders which have accumulated on our books. We desire to state that these batteries are **GUARANTEED** by this Company, just as all apparatus hitherto sold by us has been: and that the statements of our opponents regarding them, which have been so industriously circulated of late, are false in every particular.

THE BRUSH ELECTRIC CO., No. 379 EUCLID AVE., CLEVELAND, OHIO.

INCANDESCENT LIGHTS

SWAN INCANDESCENT ELECTRIC LIGHT CO.

OWNERS OF THE

SWAN PATENTS FOR THE UNITED STATES,

ARE PREPARED TO GRANT LICENSES TO COMPANIES TO SELL AND USE THE SWAN INCANDESCENT LAMP, INCLUDING OUR PATENTED HOLDERS, SWITCHES, CUT-OFFS, ETC. WE GUARANTEE OUR LAMP AND TO DEFEND THE VALIDITY OF OUR PATENTS. FOR TERMS OR INFORMATION, APPLY TO

THE SWAN INCANDESCENT ELECTRIC LIGHT CO.,

853 Broadway, Cor. 14th Street, New York.